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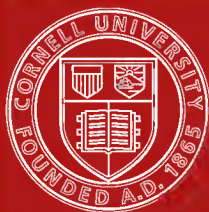
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MANUFACTURING OPPORTUNITIES IN THE STATE OF WASHINGTON



BY HARRY F. GILES - DEPUTY COMMISSIONER
STATE BUREAU STATISTICS & IMMIGRATION
I. M. HOWELL - SECRETARY OF STATE-EX-OFFICIO COMMISSIONER



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STATE OF WASHINGTON

DEPARTMENT OF STATE

Bureau of Statistics and Immigration

I. M. HOWELL, Secretary of State
Ex-Officio Commissioner


MANUFACTURING OPPORTUNITIES

IN THE

STATE OF WASHINGTON

By HARRY F. GILES,
Deputy Commissioner



OLYMPIA, WASH.
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1918



"THIS IS THE FOREST PRIMEVAL."

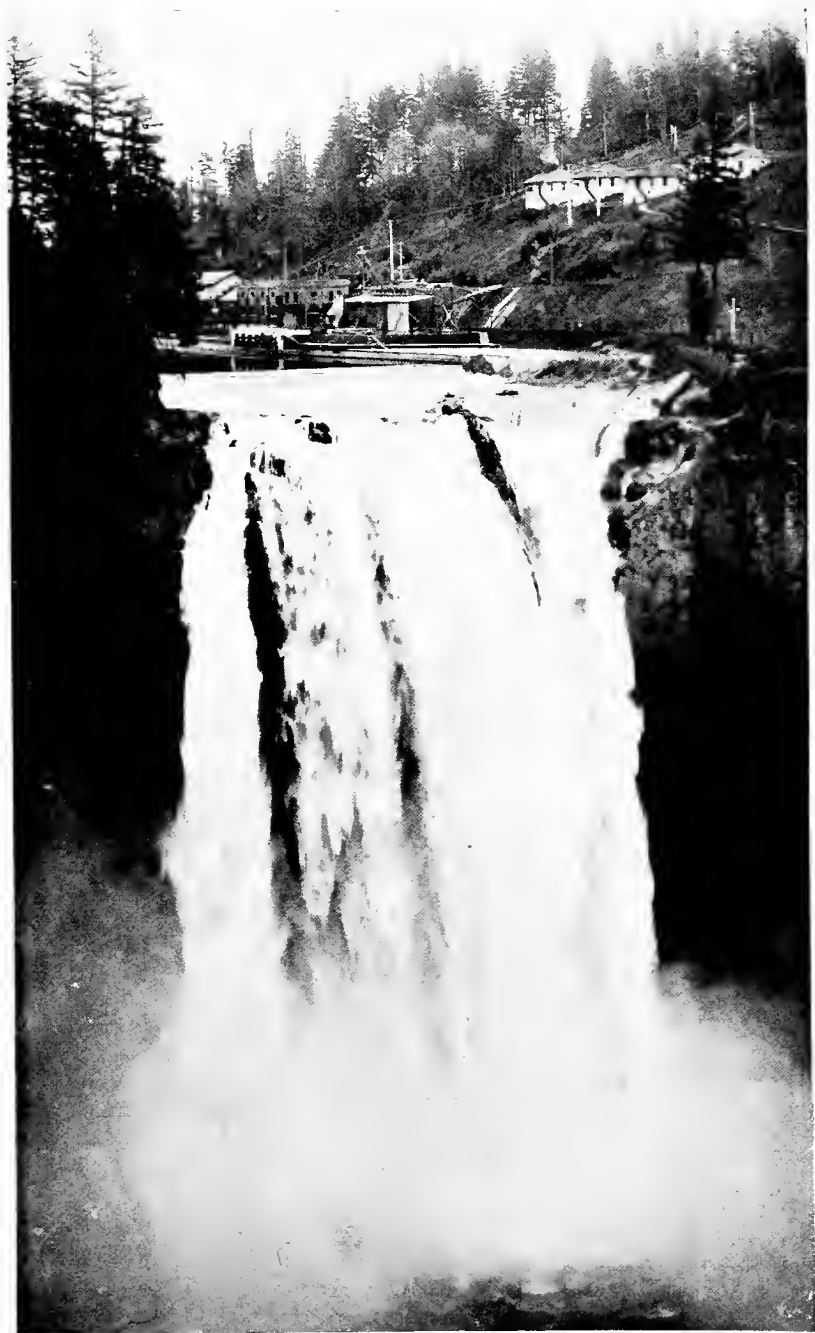
There are trees in the Washington forests over 500 years old and more than 20 feet in diameter.

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Snoqualmie Falls (268 feet) the Niagara of the West. 24,000 H. P. has been developed, and is transmitted to Seattle, Tacoma, Everett and other Puget Sound cities.

PREFACE.

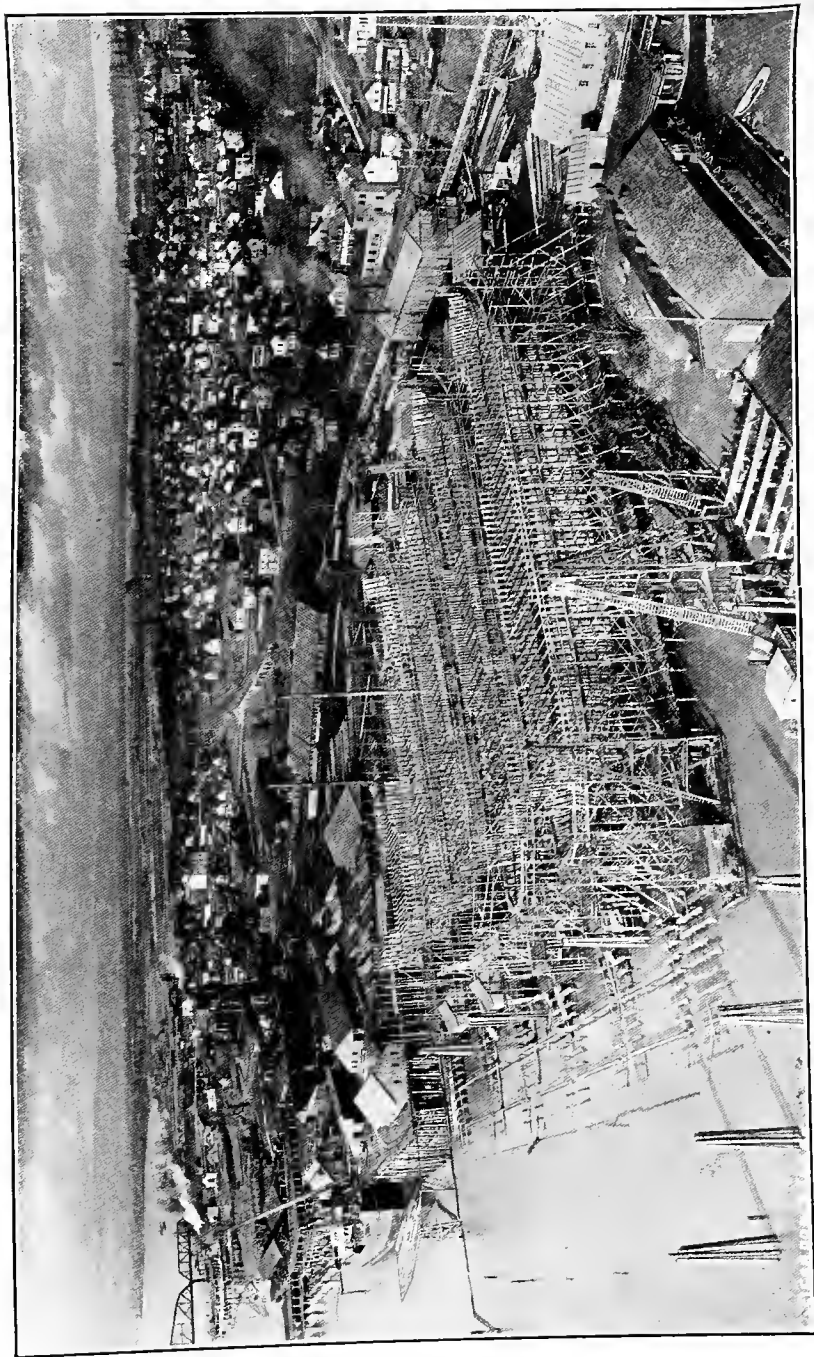
The following chapters comprise the results of a more or less complete survey of conditions favoring the establishment of additional manufacturing plants in the State of Washington. The broadness and diversity of the subjects discussed preclude the presentation of numerous details, although the essential facts bearing on an enterprise have been emphasized as much as possible.

This publication will have accomplished its chief purpose if it serves to awaken an interest in Washington's manufacturing possibilities on the part of those in a position to take advantage of the opportunities offered and encourage them to make further investigations. That there is room in this state for many additional establishments in various lines is beyond dispute, and success in many instances depends entirely upon the degree of business ability brought into play.

In presenting the individual requests of the different communities, however, no responsibility is assumed by the Bureau in the final decision as to whether any particular place fulfills all the requirements for the success of the enterprise requested. The suggestions offered here are to serve only as a guide. By following up the leads given it is hoped that the prospective manufacturer, seeking a place to ply his favorite vocation or invest his capital along industrial lines, will be enabled to find out where the best chances lie or what locations merit more thorough investigation.

Additional information will be gladly furnished and any possible assistance rendered by the State Bureau of Statistics and Immigration, the Industrial Bureau of the State University, and the Departments of Science and Engineering of the State University and State College.

It is proper here to thank all persons who by supplying information, offering suggestions, or contributing special articles have cooperated to make this compilation possible.



Wooden-ship yard and portion of manufacturing district, Vancouver, Washington. (taken from interstate bridge over Columbia river).
(Copyright by Gorton Stuart)

CHAPTER I.

WASHINGTON.

In acquiring a thorough understanding of the industrial progress which any particular territory has made and the opportunities which it presents for further development, some knowledge of its most characteristic natural features is helpful. Although a complete description of the State of Washington cannot be given in this publication, nevertheless it seems desirable to add a few statements of general significance, as a proper introduction to the chapters following and for the light they may throw on the specific subjects discussed. Persons desiring a more detailed description of the state should write to this Bureau for special publications on that subject.

AREA AND POPULATION.

Washington consists of 39 counties, the largest of which is Okanogan, in the north central part of the state, and the smallest Wahkiakum in the southwest corner. Its total land area is 66,836 square miles or 42,775,040 acres. In addition, within its boundaries are 2,291 square miles of water, making its total area 69,127 square miles. Its extreme breadth is 364 miles and the greatest distance north and south 238 miles. The population in 1910 was 1,141,990 and the United States Census Bureau estimate for July 1, 1917, was 1,597,400, or an average of 24 persons for every square mile of land.

SURFACE.

The surface presents every variety of physical formation within the range of geological possibility. The most conspicuous feature is the Cascade Mountain Range, which, rising to an average height of from 5,000 to 8,000 feet, extends in a southwesterly direction from the Canadian boundary to the Columbia river and separates the state into two important geographical divisions known as Eastern and Western Washington, which differ considerably in topography, climate, soil and vegetation.

This range includes also several mountains of national fame which reach to a height of ten thousand feet and more, among which are Mount Rainier (or Mount Tacoma) 14,408 feet, the second highest mountain in the United States proper, and one of the greatest tourist objectives in the world; also Mount Adams, Mount Baker, Mount St. Helens and Glacier Peak.

Other mountains of importance are the Olympics, a range occupying the peninsula of the same name and comprising most of the counties of Jefferson and Clallam and parts of Mason and Grays Harbor. The Blue Mountains, rather low mountains covered with pine timber, occupy a part of the southeast counties and reach into Oregon, while the Okanogan highlands, a sort of spur from the Cascades, occupy the four northern counties of eastern Washington.

All of eastern Washington and much of southwestern Washington is drained by the Columbia river and its tributaries, while the remainder of the western part of the state is drained by smaller rivers flowing directly from their glacial sources into the Sound, the Ocean, or Grays and Willapa Harbors.

AGRICULTURAL AREAS.

Sloping gently from the foothills to the Sound, the Pacific Ocean or the Columbia river on the west side, and to the Columbia river on the east side, are magnificent agricultural areas consisting of plateaus and spreading plains, occasionally interrupted by low hills or broken by beautiful, broad valleys. These areas, at times gently or roughly rolling and again perfectly level, supply the cities located in their midst with all the farm produce needed for home consumption and still have much to send to the preserving factories or to ship to distant lands.

WESTERN WASHINGTON.

Western Washington, consisting of the 19 counties west of the Cascades, was at one time all very heavily timbered with trees reaching enormous size, even twelve feet in diameter for firs and twenty feet for cedars. The sections from which this timber has been cut are now either in the logged-off state, much

of which is used for pasture, or else cleared and under cultivation. Since the soil here is generally good and the rainfall nowhere less than 20 inches annually and in most parts from 30 to 60 inches, nearly all crops grow profusely, especially oats, grasses, vegetables, and fruits, both large and small.

About two-thirds of the population of the state dwell west of the Cascades and principally in the cities located on Puget Sound, Grays Harbor, Willapa Bay, the Columbia River, and on the lines of transportation connecting these sections with each other.

TIMBER.

Much of the timber still remaining is on the mountain slopes and foothills and about a third is included in eleven United States Forest Reserves, the total area of which in the State of Washington amounts to 9,927,679 acres, while of privately owned timber there are about 5,000,000 acres additional. These reserves cover 1,534,680 acres of the Olympic Peninsula, several million acres of the Cascade range, considerable of the Okanogan highlands and some of the Blue Mountains. By far the thickest growth to the acre is in western Washington where the big Douglas fir and the red cedar grow. The eastern Washington sections have a lighter growth of pine, hemlock, tamarack and spruce.

EASTERN WASHINGTON.

Eastern Washington comprises the twenty counties lying east of the Cascades. The Okanogan Highlands occupy the main portion of the northern counties, viz., Okanogan, Ferry, Stevens, and Pend Oreille, the bulk of whose population is to be found in several beautiful, fertile valleys created by the Okanogan, Curlew, Colville and Pend Oreille rivers; although the recent throwing open of the Colville Indian Reservation has caused considerable influx of white population into this splendid section, lying just north of the Columbia and extending eastward from the Okanogan river. In the neighboring mountains and hills is much grazing and mining.

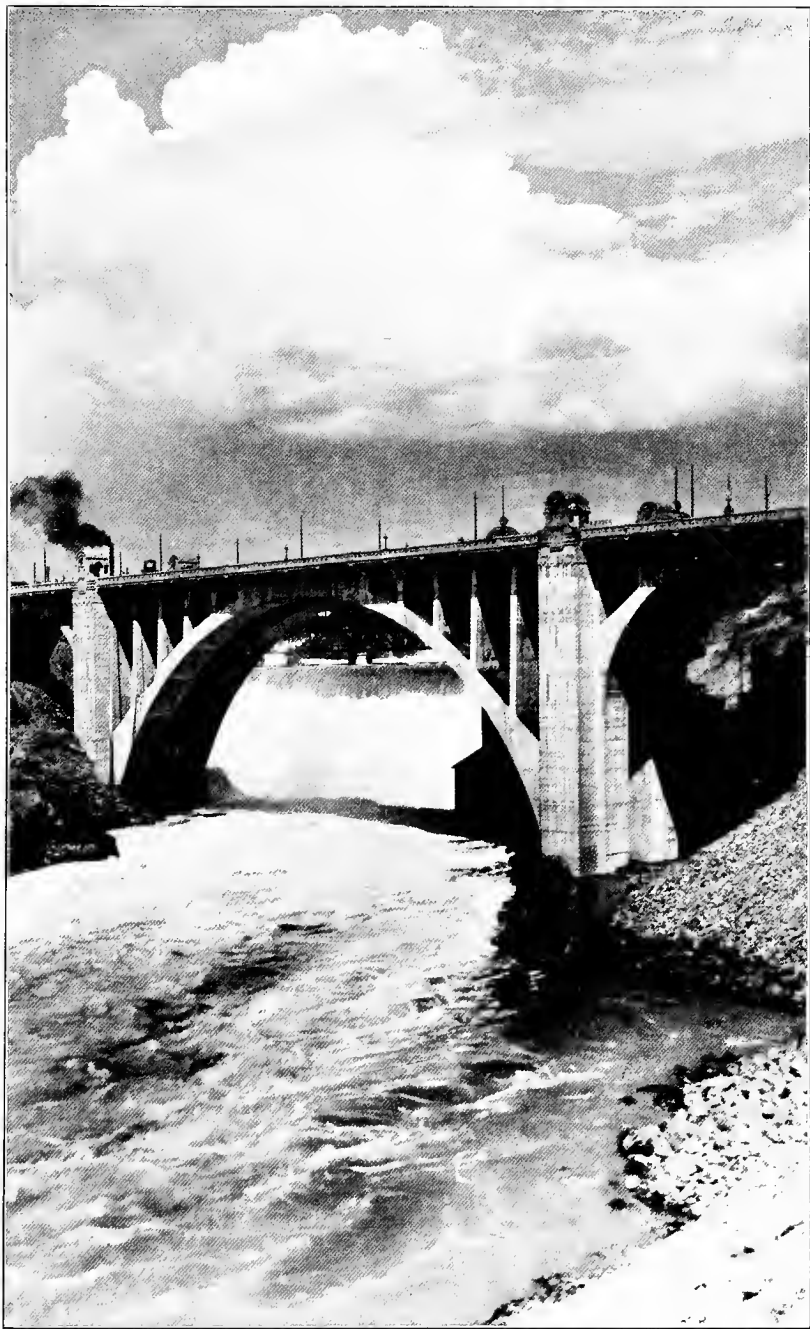
The great Columbia river plain ranging in altitude from 300 to over 2,000 feet occupies most of the remaining portion of Eastern Washington, extending from the Cascades eastward beyond the Idaho Boundary line and southeast to the Blue Mountains. The major part of this area, except the irrigated valleys, is devoted to the raising of grain, principally wheat, although many other crops and much livestock are raised as well. The rainfall ranges from 10 to 20 inches annually.

IRRIGATED SECTIONS.

Besides the wheat plateau there are a number of wonderful valleys where irrigation is successfully practiced and where the major part of all eastern Washington crops, outside of grains, is produced. The chief of these valleys are the Yakima, Wenatchee, Spokane, Walla Walla and Okanogan, although some irrigation is also carried on along the Columbia river itself and the Snake river, besides a number of smaller streams. A still smaller area is irrigated from wells. There are altogether in the state about 400,000 acres of irrigated land and of this about 300,000 acres are in the Yakima Valley. The Wenatchee Valley is devoted almost entirely to fruit production but the other valleys, in addition to fruit raising, pay considerable attention to diversified farming. Within these valleys are the largest cities of eastern Washington, where dwell the bulk of its population.

CHIEF INDUSTRIES.

The chief industries of the state are farming, dairying, fruit raising, lumbering and other manufacturing, fishing and mining. All crops in the state for the year 1916 were estimated to be worth \$128,000,000. Livestock was worth about \$47,000,000. Manufacturing probably amounted to about \$250,000,000. The fishing industry produces from \$10,000,000 to \$20,000,000 annually and mining about \$14,000,000. The total wealth of the state is about two billion dollars. Figures for 1917 are not yet available.



Lower Spokane Falls, in the heart of Spokane, the "Power City."

CHAPTER II.

DEVELOPMENT OF MANUFACTURING IN THE STATE OF WASHINGTON.

What any region can contribute toward the progress and general contentment of a people depends primarily upon the liberality with which it has been endowed with desirable resources, and the character of the men who gain control of them.

The most casual survey of the natural advantages possessed by the State of Washington and a moderate acquaintance with its men of affairs can hardly fail to convince the thoughtful person that this northwestern section of the United States is destined to become one of the great industrial regions of the world. Unlimited quantities of essential raw materials have been placed where they may be utilized to the fullest extent. So varied are these materials and so favorable the conditions surrounding them, that, as the work of development proceeds and the uses to which they may be put become more familiar, few manufactured articles of a general nature will be known which cannot be produced in this state, providing the enterprise is adapted to a temperate zone.

The time is ripe for a period of unusual progress in nearly all lines of manufacturing. Persons with foresight are beginning to realize the possibilities and are preparing to profit by the industrial growth that is expected.

TWENTY YEARS OF GROWTH.

But, leaving the contemplation of future events for the present, this chapter will be devoted to a brief outline of what has already occurred, especially during the past 20 years. The development of the state during that period has been in many respects remarkable. In 1890, the year after admission to the Union, the total value of all manufactures was reported by the United States Census Bureau to be \$41,768,022. By 1899 it had more than doubled, amounting to \$86,795,051, which for comparative reasons was reduced to \$70,831,000 by elimination

of many small concerns not conducted according to regular factory methods. In 1904 the value of all manufactured products amounted to \$128,822,000, representing an increase of 81.8 per cent. over what it was five years before. The regular census report of 1910 shows that the total value of manufactured products had advanced for the year 1909 to the stupendous sum of \$220,746,000, which represents the largest increase during any five year period in the history of the state, being 71.4 per cent. over that of the year 1904 and 211 per cent. over the year 1899.

RECENT DEVELOPMENT.

The rate of increase during the years from 1909 to 1914 was considerably less than for any equal previous period, but the same was true for practically all other parts of the United States and for much of the rest of the civilized world, since a process of liquidation was going on while we were recovering from the preceding years of inflation.

This brief retardation has been more than offset, however, by the rapid development which has occurred since 1914. If the figures could now be obtained for the year 1917, they would undoubtedly record a much larger increase than ever before. The industrial awakening which started near the Atlantic seaboard, closest to the scene of the European conflagration, spread rapidly toward the Pacific Coast; where dense forests of giant trees envelop mountains whose rugged slopes conceal unlimited quantities of useful and precious metals and concentrate the rushing waters into falls of sufficient potential power to turn the mills of the world; where rich agricultural areas capable of producing a profuseness of crops are within easy reach of the sea, which also yields freely various foods and materials and receives the great ships building at every port.

Quickening to the keen demands of the day, all things seem to have increased in prolificness. Fishermen have met with signal success and the canneries of the Coast have been taxed to their full capacity. The farmer, the dairyman, the stockman and the orchardist have laid hold with added zeal, to compel

the rich soil to yield its utmost and supply fruit and vegetable canneries, condenseries, meat packing establishments, flour mills and other food preserving plants with the materials which will ultimately feed those living where such things do not thrive, or people too busy in other pursuits to attend to the details necessary for their successful production. Thousands of huge logs are being cut from the forests and manufactured into lumber, either to be shipped to distant lands less fortunate in this respect than the Pacific Northwest, or to supply the needs of our own citizens already engaged in the work of empire building, and for the construction of great cargo-bearing ships for carrying other products across the seas.

SCIENTIFIC INVESTIGATIONS.

Instead of being satisfied with progress made at any particular time, investigations have been made and are being continued by federal authorities and state institutions to discover other lines that might deserve attention. As a result, many new fields for the manufacturer's activity are being found. Beet sugar and starch factories, paper and pulp, also steel manufacturing, besides many miscellaneous lines mentioned elsewhere in this publication, have been shown to offer possibilities, while for wooden shipbuilding and airplane construction it is generally admitted that no location anywhere is more favorable.

STATISTICS OF CAPITAL AND LABOR INCREASE.

Such increase in manufacturing, of course, implies a proportionate growth in the capital invested and indicates a much larger army of wage earners engaged. In 1880 there were only 261 establishments of all kinds, including even the small ones which are not counted in later census reports because of not being managed under the factory system. These 261 concerns employed 1,147 men and represented invested capital amounting to \$3,202,497. By 1914 the number of establishments had increased to 3,829, which gave employment to 67,205 wage earners and represented of invested capital nearly \$300,000,000, or about one-seventh of the entire wealth of the state.

Between 1899 and 1914, a period of fifteen years, the number of establishments and wage earners had doubled, the capital invested had increased 568 per cent. and the yearly value of manufactured products had increased 245 per cent., thus raising the rank of the state to 23d in the Union in reference to value of products and 19th in reference to value added by manufacture.

It may be safely estimated that during the period of twenty-five years from 1889 to 1914 altogether about three billion dollars' worth of goods were manufactured in Washington, representing about \$150 for each person living in the state during any one year, or \$3,750 for each person living in the state the entire twenty-five years, and proportionate amounts for those living in the state shorter periods. For the year 1914, when the population was about one and a half millions, the output for each person was about \$163.00. In the year 1909, with a population of 1,141,190, the value per person was about \$168.00.

TABLE SHOWING GROWTH OF MANUFACTURING
FROM 1880 TO 1914.

YEAR	Population	Establishments	Wage Earners	Capital	Value of Products	Value Added to Manufacturing	Average Per Capita
1880.....	75,116	261	1,147	\$3,202,497	\$3,250,134	\$1,282,665	\$43
1890.....	357,232	1,543	18,677	34,369,735	41,768,022	21,850,965	117
1899.....	518,103	1,926	31,523	41,575,000	70,831,000	32,554,000	126
1904.....	700,000	2,751	45,199	96,953,000	128,822,000	62,656,000	184
1909.....	1,141,990	3,740	69,120	222,261,000	220,746,000	102,858,000	168
1914.....	1,500,000	3,829	67,205	277,715,000	245,326,000	108,717,147	163

COMPARISON WITH OTHER INDUSTRIES.

Manufacturing, of course, holds an important relationship to all other industries, since it depends on them for the materials needed in the process of transformation. In this state it ranks next to agriculture in relative importance. The value of all manufactured goods for the year 1914 amounted to \$245,326,456, or about one-eighth of the entire taxable wealth of the state, but the increased value from manufacturing amounted to \$108,717,147. During that same year the value of all crops was nearly \$100,000,000, while livestock, dairy and poultry



No. 1. Opening of Lake Washington Canal, which added 100 miles of fresh water frontage to Seattle's already extensive shoreline.
 No. 2. Harbor Island, one of Seattle's most important manufacturing districts.

products would add many millions more, and bring the total from all agricultural pursuits to approximately \$125,000,000, or about 15 per cent. more than from manufacturing. Although manufacturing has reached much larger proportions for the year 1917, agriculture also has increased. Fishing, next in importance, yields annually from \$15,000,000 to \$20,000,000 and mining about \$14,000,000. Thus it is apparent that about one-third of the annual wealth production of the state is from manufacturing alone.

These figures represent the results of normal times, and will undoubtedly be surpassed by the returns for the year 1917, which will surely record a marked increase, due not alone to abnormal values but also to the larger production in every line of industrial endeavor. Every eight years, during normal times, we have practically reproduced the taxable wealth of the state from manufactured products alone, but recent developments will undoubtedly cause such results in a much shorter period.

IMPORTANT PRODUCTS.

Although Washington ranked 23d in value of all manufactured products and 19th in increased value from manufacture, in a number of lines of supreme importance it stands in the front rank. Of these lumber and lumber products, fisheries products, dairy products, flour and grist mill products, cement manufacturing, clay products, fruit and vegetable canning and ship building stand out most prominently. Several of these have such an important relation to the manufacturing progress of the state that special chapters have been devoted to them, where more details may be given and all important facts connected with them, bearing on the general subject of manufacturing, brought to the attention of the reader. Only a brief mention of each one will be made here.

RANKS FIRST IN LUMBERING.

By far the most important of these are lumbering and allied woodworking industries. For the year 1914 the total value of all lumber and timber products was \$83,535,760, or 34 per cent. of the entire manufacturing output. About four billion feet of lumber are cut annually, but enough timber

still remains in the forests to last another hundred years at practically the same rate of cutting and without considering the increased production through efforts at reforestation. Washington soil and climate are well adapted to tree growth, only 75 years being required to reproduce marketable timber. Out of the magnificent growth of red cedar are manufactured two-thirds of all of the shingles produced in the United States. In the annual output of lumber for the past ten years, except one, Washington has ranked first in the Union, and its total production during the ten-year period amounted to nearly forty billion board feet, worth as rough lumber more than \$500,000,000, a truly substantial contribution to the wealth of the country. This has found its way to South American ports, British Columbia, Alaska, eastern United States and European and Asiatic ports.

LUMBER PRODUCED IN WASHINGTON DURING THE YEARS
1907 TO 1916 INCLUSIVE.

	Bd. Ft. Cut	Value
1907	3,777,606,000	\$54,849,114 00
1908	2,915,928,000	37,090,925 00
1909	3,862,916,000	51,083,399 00
1910	4,097,492,000	68,786,820 00
1911	4,064,754,000	59,856,159 00
1912	4,099,775,000	49,690,032 00
1913	4,592,053,000	.....
1914	3,946,189,000	.....
1915	3,950,000,000	41,814,078 00
1916	4,492,997,000	53,159,502 00
Total for 10 years..	39,799,710,000	.....

FISHERIES PRODUCTS AND LIVESTOCK.

With the keen demand for foods and the growing scarcity of domestic animals, which are being rapidly slaughtered in many places to provide meat diet or because of the higher cost of feeding them, the development of Washington's fish and livestock products is of extreme importance. Livestock in the state being valued at about \$50,000,000, and the annual production of salmon and other fish products amounting to from \$10,000,000 to \$20,000,000, Washington is surely doing its

share towards feeding the armies in the field as well as the civilians at home. During the year 1914 the total products from meat packing, including beef, veal, mutton and lamb, pork and other fresh and cured meats and miscellaneous products, amounted to \$18,443,526. In 1909 the value was \$15,653,998, and in 1904, \$6,251,705, representing an advance of about 200 per cent. for the year 1914 over what it was in 1904.

The value of canned fish alone for the year 1914, one of the "off" years, according to the United States Census report was \$7,634,000, an amount surpassed by no other state but Maine and then by only about \$20,000. Washington is the leading district for canned salmon, including the Puget Sound, Columbia river and Alaska products. A special bulletin on this subject may be obtained by writing the State Bureau of Statistics and Immigration, Olympia, Washington.

CEREAL PRODUCTS.

Flour and grist mill products and opportunities for further development along this line will be considered in a special chapter, but a brief statement is warranted here. Government reports show that 37,635,000 bushels of wheat valued at \$53,818,000 was produced in 1916 and that the annual yield sometimes goes much higher. Of oats, 14,300,000 bushels were produced; of barley, 6,814,000 bushels; and corn, which is just beginning to be raised in the state, amounted to 1,406,000 bushels. The value of products manufactured from all these is second only to the lumber industry and amounted in the year 1914 to \$23,665,000. This industry was represented by 100 establishments, which produced 3,765,070 barrels of flour, valued at \$15,685,353; 120,260 tons of feed and offal, valued at \$3,588,665; 121,537 tons of bran and middlings, valued at \$2,675,237; 8,413,648 pounds of breakfast foods, worth \$251,117; besides rye flour, barley meal and other cereal products, bringing the total up to the figures mentioned.

During the five years from 1909 to 1914, wheat flour manufactures increased from 2,804,242 barrels to 3,765,070 barrels, representing an increased value of 25.6 per cent. In addition there were manufactured of bread and other bakery products,

amounts worth \$6,572,000 in 1914, as against amounts valued at \$4,570,000 in 1910, and \$656,000 in 1904.

DAIRY MANUFACTURES.

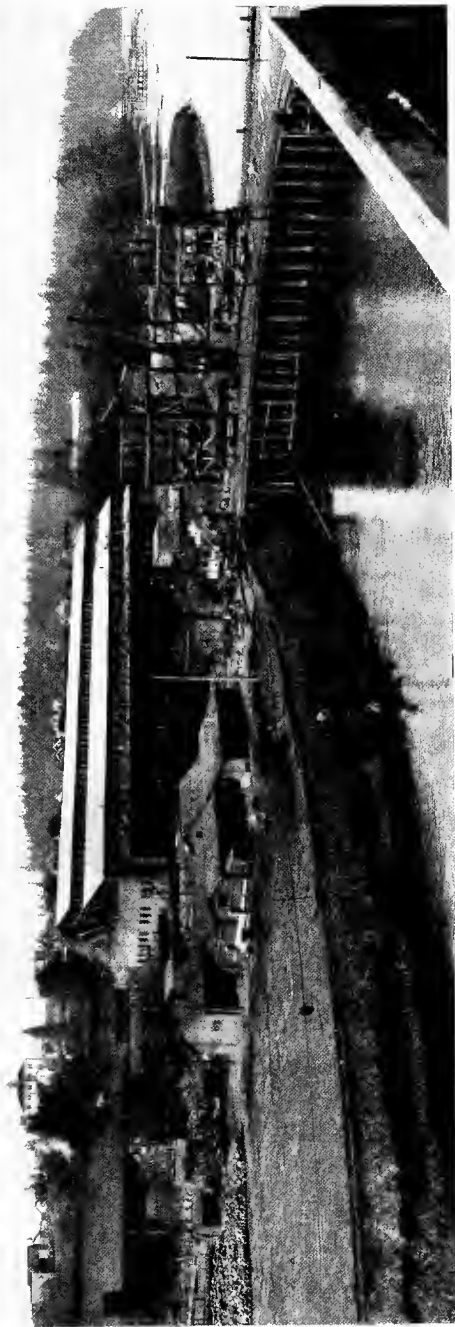
No industries have advanced faster and probably none present greater opportunities for the future than those connected with dairying and livestock production. Since 1904, the total annual increase in butter, cheese and condensed milk, according to the U. S. Census, has been about 300 per cent. While in 1904, 7,722,911 pounds of butter, worth \$1,968,682, were sold, in 1914, 16,813,044 pounds valued at \$5,107,803 were sold—an annual increase in quantity of about 117 per cent. within 10 years, or 48.8 per cent. within the last five year census period. Cheese increased from 921,383 pounds to 1,355,423 pounds, while condensed milk, now one of the most important manufactures connected with dairying, grew from practically nothing to about \$5,000,000.

SHIP BUILDING.

The development in ship building has been almost startling. Previous to 1917 very few vessels of any consequence had been built except the U. S. battleship Nebraska, constructed in a Seattle ship yard in 1908. In 1914 there were 61 ship and boat building plants reported, but very few ships of importance were being built. Today there are contracts for great cargo ships amounting to more than \$200,000,000. The leading facts connected with this industry are discussed in a special chapter.

AEROPLANES.

The latest line of importance is the construction of aeroplanes. Washington possesses the most essential of all factors for this enterprise, namely, a large supply of high grade spruce timber, pronounced by government experts to be the ideal wood because of its toughness and comparative lightness. This tough light timber, of which there are more than twelve billion feet in the state, has of late become so valuable that it is barred from all lines of construction in which any other kind of wood will do, for there is no material that can take its place with the same



No. 1. Tacoma steel-ship building plant nearing completion. No. 2. Partial view of Tacoma's big smelter. Annual output is valued at \$40,000,000. One-twelfth of copper output of the United States is refined here.

degree of efficacy. Already a few aeroplanes have been built in the state, but the next year or so will probably find Washington one of the foremost districts in this respect.

PAPER AND PULP.

Much headway has been made in the paper and pulp industry. The favorable conditions, especially plenty of suitable timber, according to a number of experts, promise a rapid advancement in that line. There are at present four large paper plants in the state, one each at Everett, Camas, Sumner and Spokane. A number of others are being located or planned for location at favorable points.

OTHER IMPORTANT MANUFACTURES.

Among other important manufactures amounting to more than a million dollars each in 1914 and which have continued to make tremendous increases, are cement, amounting to \$2,639,219 from five plants; brick and tile, terra cotta and fire clay products, amounting to \$2,026,801 from 40 establishments in 1914, as against \$1,091,000 from 57 in 1904; confectionery, amounting to \$1,783,000 from 67 establishments in 1914, as against \$1,311,000 from 28 establishments ten years before; copper, tin and steel, amounting to \$1,620,000 in 1914 from 112 establishments, as against \$727,000 from 33 establishments in 1904; furniture, which amounted, in 1914, to \$1,098,000 from 50 establishments, as against \$625,000 from 23 plants in 1904; illuminating and heating gas, which in 1914 returned \$2,639,000 from 13 plants, as against \$602,000 from 7 plants in 1904; and cars and general shop construction and repairs by steam railroad companies, which increased from \$2,769,000, the product of 10 plants in 1904, to \$7,027,000, the results of 26 plants in 1914. Roasting and grinding of coffee and spice increased from \$524,000 to \$2,237,000 in the same period; foundry and machine shop products increased from \$3,945,000 to \$6,837,000; printing and publishing increased from \$4,765,000 to \$9,824,000 in ten years; and malt liquors, whose manufacture has since been prohibited by law, but which is now being supplanted

by the manufacture of various fruit juices, grew from \$4,472,000 to \$9,458,000 in the same ten-year period.

Many other minor industries have also attained prominence during the past ten years. Some of these, although affecting the total figures very little, are important as regards their general bearing on the manufacturing progress of the state and proving its suitability for industrial diversity. Among the minor manufactures are leather goods, tobaccos and cigars, mattresses and spring beds, cooperage goods, mineral and soda waters, ice, awnings, tents and sails, besides clothing, agricultural implements, chemicals and various other miscellaneous manufactures, such as ink, hats, glass, fertilizers, fireworks, cordage and twine, bags, cigar boxes, brushes, buttons, etc.

Every year new lines of manufacturing are attempted. Many of them succeed and constitute further proof that the State of Washington is not confined to a few lines only, but can successfully engage in nearly all lines for which the necessary raw materials can be produced in a temperate zone or be shipped at a profit from some other part of the planet.

MANUFACTURING DISTRICTS.

Although industrial expansion has occurred in many parts of the state, the development experienced in the different places is not always along the same lines. Other things being equal, the largest centers will usually attract the greatest number of enterprises. But in many instances local conditions or superior advantages will play an important part in the encouragement of such enterprises. This is especially true regarding those industries which can best be handled close to the source of raw material, such as preserving, canning, milling, sugar refining, lumbering, etc., although the excellence of our transportation facilities permits the carrying of certain materials a considerable distance—a wise and profitable thing to do when the other essential conditions are already present at any particular place. In cereal, fruit and vegetable products, Eastern Washington, where the largest improved agricultural areas exist, has made the most headway. In lumber and remanufactures therefrom,

ship building and fisheries, the western part of the state must naturally claim the lead.

Practically all lines of manufacturing are carried on in Spokane, the metropolis of the Inland Empire, as they are in Seattle, Tacoma, and the other larger centers of western Washington. The manufactures of each of these three cities for the year 1914 amounted to \$16,636,309 for Spokane, \$27,707,606 for Tacoma and \$64,475,442 for Seattle. The other cities for which special figures were supplied by the U. S. Census were: Aberdeen, \$4,815,113; Bellingham, \$6,264,307; Everett, \$6,530,405; Hoquiam, \$5,009,410; Yakima, \$1,937,461; Vancouver, \$1,301,048, and Walla Walla, \$2,014,673. The population of these cities ranges from 12,000 to over 300,000. Other important manufacturing centers with less than 10,000 inhabitants are Port Angeles, Port Townsend, Anacortes, Snohomish, Puyallup, Olympia, Centralia, Chehalis, Ellensburg, Wenatchee and the Willapa Bay, and several Skagit valley cities. Many other towns are gradually attaining greater proportions and some of them will probably in time become important manufacturing centers.

POTENTIALITIES.

But it is not so much with achievements as with potentialities that the average person who reads this book is most concerned. His question is, what are the lines that still offer opportunities and what are the reasons for such expectations? The following pages represent an attempt to answer such questions as fully as possible. Mention is made of all conditions that seem to favor development and some consideration given to the reasons for expecting such development. No effort is made, however, to minimize the value of experience and well directed effort, which are always necessary in every legitimate line of endeavor. Capital and captains of industry are of course needed for the greater accomplishments; but many opportunities for less pretentious enterprises are awaiting those persons having only limited capital, who possess enthusiasm, and confidence in their own ability to win success.

CHAPTER III.

ADAPTABILITY OF THE STATE FOR MANUFACTURING.

In order for any section of a country to attain industrial magnitude, certain natural advantages are essential. The needed raw materials must be present in commercial quantities and they must be found where the transportation facilities are sufficient. Plenty of cheap power is necessary. Good factory sites must be obtainable on reasonable terms. Markets to absorb the finished products must exist or the chances for creating them must be apparent. Labor conditions must also be satisfactory, while the climate should be such as to render outdoor work possible most of the year and the general environment such as to appeal to man when choosing a place for his home.

There are also a number of advantages that are more or less local in their nature, and the extent of development made possible by these fundamental requirements in any particular section will depend in a measure on the special conditions which obtain there. In a state of such varied resources and diversified interests and occupations, it follows that some industries which attain a high development in one locality might be unsuited to another. Considered, however, along general lines, that portion of the North American continent included within the boundaries of the State of Washington seems to contain the essentials for producing a manufacturing district equal in importance to any in the United States.

Since most of these advantages are discussed in connection with the various articles on specific subjects, this chapter will be devoted to a brief consideration of such advantages in their relation to the broad field of manufacturing in the State of Washington, leaving detailed discussion and special applications to other chapters.

EARLIEST MANUFACTURING CENTRES.

With few exceptions, the most important industrial centres of the world have been located in the north temperate zone, and have attained their greatest proportions where transportation and power can most cheaply be made to meet. In the early history of this nation, when power-manufacturing in various lines

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began first to be developed, the need for securing direct water power, converted by means of over-shot or under-shot wheels, caused mills and factories to be built along streams where water-falls or swift currents were available; and the raw material was transported to, and the finished product conveyed from, the mills, first by boat or wagon, later by steam cars. In this way such manufacturing districts as those of New England and other Atlantic seaboard states were developed, where the mountain streams of the Appalachian watershed dashed swiftly downward toward the sea.

The discovery of the vast coal beds of Pennsylvania and other states, and the improvements of the steam engine with its various applications, provided a new power supply. These improvements and the ease of transporting coal from the mines to the harbor ports caused great manufacturing districts to spring up in such cities as New York, Baltimore, Philadelphia and Boston, on the Atlantic coast, or as Detroit, Cleveland and Chicago, on the Great Lakes.

During the past score of years, new inventions and the discovery of new principles have brought about new applications of old forces, so that today, electrical energy, cheaply generated by water power or steam, can be transmitted many miles at a low cost and with little loss. Individual motors are taking the place of intricate shafting and belt drives in the modern factories, thus insuring greater conservation of power and more safety to employees.

UNLIMITED POWER.

Among the immediate advantages to the Pacific Northwest of such advancement is the possibility of utilizing more of the almost unlimited water power located in its hills and lofty mountains. The State of Washington is particularly fortunate in this regard, for it possesses nearly one-fifth of the entire potential water power of the United States, and most of this is so located that it may be readily and cheaply transmitted to all the great manufacturing centres of the state and neighboring territory.

Supplementing it, is the dormant power reposing in the enormous beds of coal in our own state and the greater coal fields

of Alaska, lying, as it were, next door, together with the vast quantities of unmerchantable timber of our dense forests and the waste from the sawmills engaged in manufacturing lumber for the market. All this material is so located as to be readily accessible to either rail or water transportation.

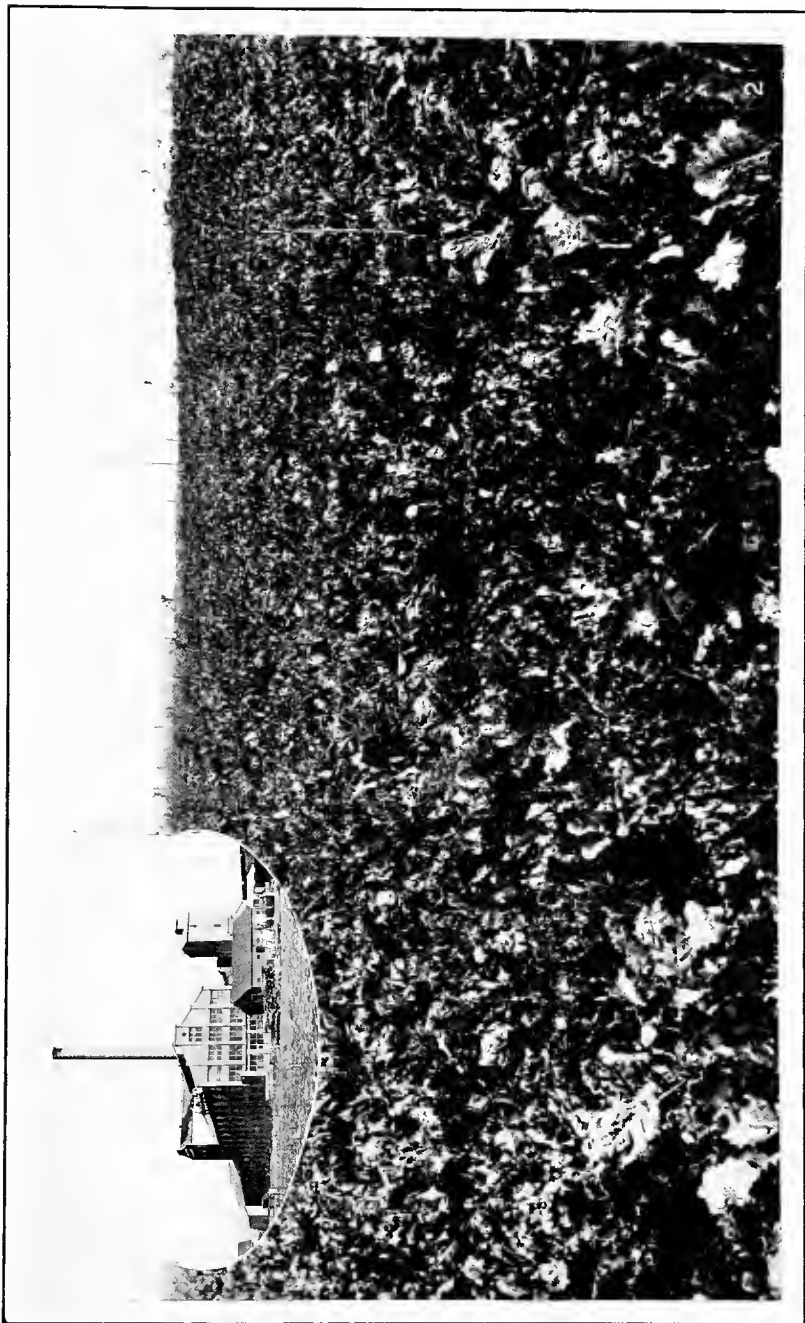
RAW MATERIALS PLENTIFUL.

Raw materials of many varieties are abundant. Even if a wall were built around Washington, its chances for developing into a greater manufacturing region would be excellent. Its forests comprise some of the richest bodies of timber known. The waters of its rivers and inland seas teem with many varieties of edible fish, and the efforts of the State Fish Commissioner are directed toward their increase and protection from ruthless fishermen. The fertile valleys and plains are capable of yielding still heavier crops of fruits, vegetables and grains. Dairying and livestock do well in nearly all parts of the state, and some sections are unsurpassed for such industries. In addition, it possesses extensive beds of clay of all kinds, large deposits of silica and lime, rich copper mines, and, in lesser quantities, iron, and most of the precious and semi-precious metals, besides many less important minerals.

NEIGHBORING TERRITORY.

The importance of Alaska to the State of Washington is discussed in a special chapter, but the natural advantages offered by the neighboring territory, Idaho, Oregon and British Columbia, should not be overlooked. These three sections contain a total area of 536,442 square miles and a population (1916) of 1,647,707, which, added to that of Washington, aggregates 605,569 square miles of territory and a population of 3,181,928.

Vast water power and additional raw materials are found in these districts, while ever improving facilities will permit their transportation to the manufacturing centres of any of the four commonwealths. These materials represent some of the richest gold, silver, copper, and coal mines in the world, extensive agricultural and grazing areas, additional forests of big timber, and, excepting Idaho, valuable fisheries resources.



Sugar beets in the Yakima valley and a refinery with 600-ton daily capacity, constructed in 1917. This is a new industry in Washington but is rapidly taking its place as one of the most important in the state.

Their people are also of the true western type and anxious for the development of the Northwest. A rapid increase in population, as shown by recent census reports, is taking place, which must also tend to expand the capacity of the local markets and increase the available supply of skilled workmen.

COMMERCIAL ADVANTAGES.

The geographical location of the State of Washington and its exceptional transportation facilities insure for it a rapid commercial development. Although today its leading manufacturing establishments are engaged principally in converting into useful articles raw materials produced locally, the day is not far distant when this state's far-flung lines of commerce will bring to its cities the materials of every land, and when its factories, as one eastern city now boasts, will produce "everything from battleships to bon-bons." These raw materials will be brought in ever increasing cargoes from Alaska, South America, the Orient and the Islands of Southern Seas; also through the Panama Canal from the Atlantic and Gulf coasts, from the eastern parts of South America, from Europe and possibly Africa, here to be combined with our own natural products and transformed into all manner of useful articles for distribution throughout the civilized world.

Here, on the Pacific Coast, under the shadows of the snow-clad mountains, power now sleeping in the hills or dashing untrammelled down their turbulent torrents will turn the wheels of great textile mills, where the cotton of the southern states and of the Orient, the wool from the western ranges, from Australia and the far East, and the silks of China and Japan, will be spun and woven into fabrics. This potent energy will some day move the machinery of huge leather and rubber factories, where hides from South America, Australia and South Africa, and crude rubber from the Orient will be transformed into boots and shoes, automobile tires and many other articles of commerce, and will drive the engines for great iron and steel plants where every variety of tools and machinery will be produced from iron ore, mined not far from our own mills or brought back as return cargoes by vessels that carry our products to foreign lands.

AVAILABLE SITES.

Not the least important advantage which this state affords for the encouragement of new industries is extensive factory area, well located with respect to transportation and sources of material. In every city of the state where manufacturing plants are called for, or where they may be expected to succeed, plenty of land suitable for such purposes is available, for most of the cities are built either on rivers or on the inland seas where all the requirements of factory sites are present. Many of these locations can be secured by responsible companies gratuitously or for a very reasonable purchase or rental price. The table on page 206 shows the cities which will furnish free sites or render other substantial assistance, and indicates also with whom to correspond for further information.

CLIMATIC ADVANTAGES.

The climate of Washington, already referred to, is favorable not only to agricultural pursuits and the growing of heavy crops, but peculiarly so for many kinds of industrial pursuits. Nowhere in the state can it be said that there are extremes of heat or cold. The U. S. Weather Bureau report for Seattle, which is typical of most of western Washington, shows that for the past twenty-one years, the lowest temperature experienced was 11 degrees F. above zero, while the highest was 96 degrees. The mean annual temperature for this period was 51 degrees, while its average rainfall was 36.6 inches, as compared with 44.6 inches for New York, 57.4 inches for New Orleans and 37.2 for St. Louis.

The extremes of temperature are somewhat greater on the east side of the mountains, but a less humid atmosphere largely compensates for this difference. The annual normal temperature for the Spokane country is 48 degrees, and in the vicinity of Walla Walla 53 degrees. The lowest monthly normal near Spokane is 27 degrees and at Walla Walla 33 degrees. The highest monthly normal near Spokane is 69 degrees and near Walla Walla 74 degrees.

Such a climate permits work with very little interruption throughout the year; there are few days when outdoor labor is

suspended or even retarded. Pipes seldom freeze and no one ever dies of sunstroke or heat prostration. A saving is made in the cost of construction in many cases because it is not necessary to provide against hard freezes, deep snows and penetrating winds. The efficiency of steam plants and of gas is not lowered by extreme cold and the cost of heating factories and mills is reduced to a minimum. Electrical plants are not endangered nor wires subject to disturbance by thunderstorms. Navigation on Puget Sound is never interfered with by ice or wind.

LABOR CONDITIONS AND WAGES.

These conditions also have a beneficial effect upon labor by keeping the operators contented with their surroundings. One laboring man was recently heard to remark, "I could make more money back in (naming one of the central states), but it is worth a lot to live in a country like this, where you don't freeze in the winter or roast in the summer; where you can sleep comfortably every night, breathe pure air and wake up in the morning feeling rested." He might also have added: "where everyone who wishes can grow enough vegetables and fruit on one or two ordinary city lots to supply his family; where in most cases one can look from his window upon scenery which rivals that of Switzerland or Italy, or if he desires, follow the inviting trails or highways which lead into the midst of the mountains and forests, where may be enjoyed every variety of healthful recreation and outdoor pleasure which is today recognized as essential for the highest quality of work in any department of a great industrial plant, from the manager's office to the shop floor."

The net result to Washington manufacturers of all these favorable climatic conditions, if reduced to figures, would represent from 15 to 18 per cent. greater efficiency than that realized by most eastern manufacturers. In the meantime the employee can be happy and made to feel that life is really worth living. Factories requiring large numbers of skilled employees will find no difficulty in attracting workmen to the Coast when once they are assured of employment and made familiar with the many advantages of the far West.

In connection with this phase of the subject, too, it should be noted that whatever advantage may have been enjoyed in the past by eastern manufacturers on account of the lower wage scale obtaining in their sections of the country, has now been practically annulled by the rapid increases which have taken place in the East, thus bringing wages in the East and in the West to practically a common level.

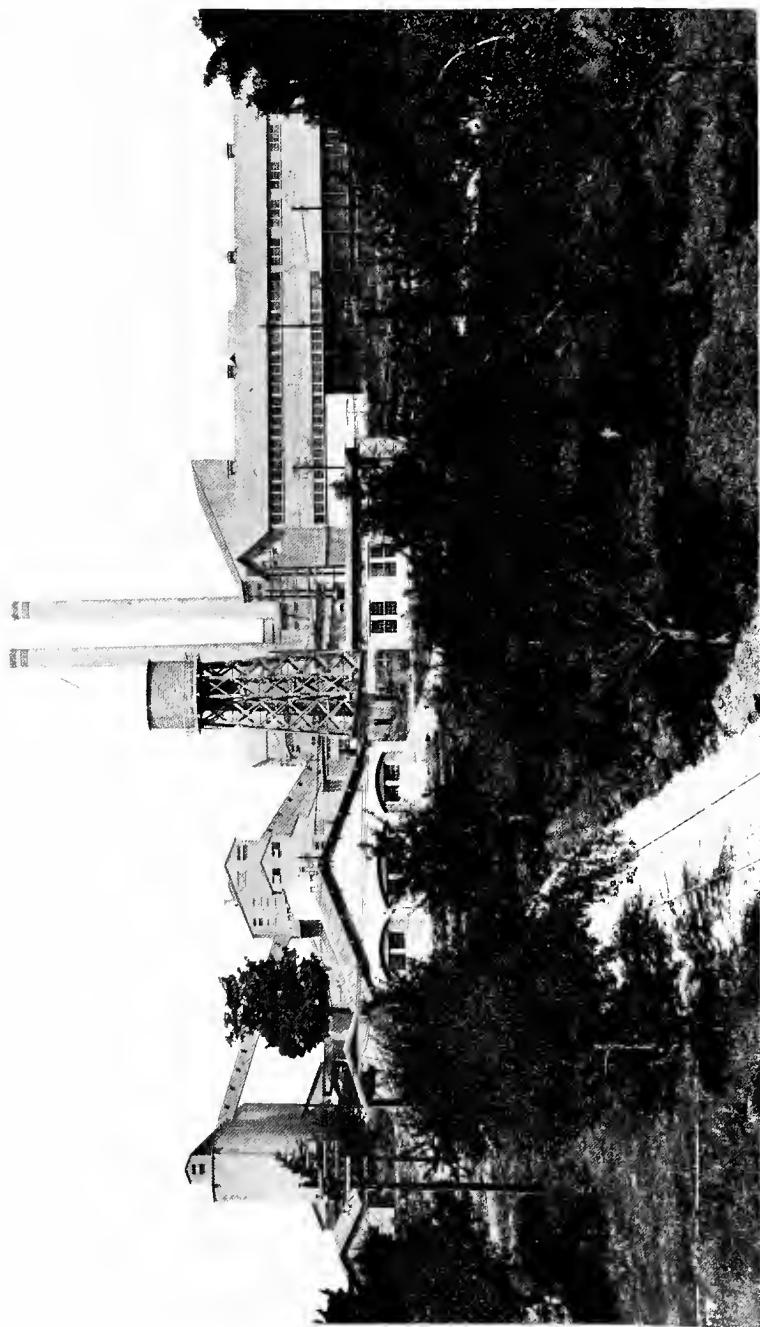
A PROGRESSIVE PEOPLE.

The people living in Washington are as a whole of an unusually progressive type and ready to adapt themselves to new lines of work or new methods in performing them. Drawn from nearly every state and nation, the process of immigration has exercised a sort of natural selection, those locating here being generally men and women with energy and ambition. In order that their children and those of future immigrants may be equipped to meet their responsibilities, they have built up a public school system second to none; one which has pioneered in the modern lines of manual and technical training and one which offers systematic and intensive instruction in all lines of recognized importance.

SUMMARY.

Summarizing, the State of Washington is richly endowed in reference to five of the six basic elements necessary for the development of a great industrial section, namely, raw material, transportation, power, factory sites and markets; and presents the most favorable conditions for the sixth, labor, offering as it does a most healthful and agreeable environment to all who toil for a living.

As the industrial development of the state advances, these advantages will be felt still more, for there is a cumulative value in every added factory; the products of one plant may furnish material for the operation of several others, while the expected increase in immigration will strengthen the local market for many lines of goods now manufactured. Further stimulus will be given by the opening of new and greater world markets and the commercial activity which must follow the close of the international conflict.



Modern cement works at Bellingham. Present capacity, 3,000 barrels per day. Ultimate capacity 10,000 barrels per day.

CHAPTER IV.

TRANSPORTATION ADVANTAGES.

The State of Washington possesses exceptional transportation facilities both by land and sea. As a Pacific Coast state it enjoys all the benefits that proximity to a great ocean always insures. But it is more fortunate than most coast regions in the possession of extensive water transportation between different points within its own boundaries and connecting with the ocean itself. Puget Sound reaching with its several arms into the heart of the state, Grays Harbor and Willapa Bay indenting it in the southwest, and the navigable Columbia circling through the eastern Washington region, and bounding the state on the south, together with its tributaries and other navigable streams, are potent factors in developing a superior transportation system.

To reach this rich section of the Northwest was the aim of all the great western railroads. As a result Washington is served today by five transcontinental lines which connect with the ocean carriers at tidewater and transfer the products brought by lateral and local lines from all other parts of the state, thus bringing the advantages of coastal proximity to every city within its boundaries. To increase the efficiency of these roads, several car ferries operate between points on the east and west side of Puget Sound, one of these connecting with the branch railroad to Port Townsend and Port Angeles, and another serving the Puget Sound navy yard at Bremerton.

Along the two thousand or more miles of shoreline on Puget Sound and the freshwater lakes connected with it by the recent building of the Lake Washington canal, on Grays Harbor and Willapa Bay, and on the banks of the Columbia and a number of smaller rivers, may be found many ideal sites for mills and factories where deep water vessels can load at the factory docks. Other sites are found along the banks of streams removed from the immediate advantages of tidewater, but paralleled by railroads and highways which render all the service desired by any manufacturing concern.

There are altogether about 1,200 miles of navigable stream in the state. The most important rivers besides the Columbia are the Snake, the Pend Oreille, the Okanogan, the Chehalis, the Skagit and the Snohomish. There are also several other lakes not connected in any way with the tidewater, on which regular steamers, ferries and other craft operate.

Two hundred and sixty-five steamboat companies operate boats on the inland waters of the state, some of these owning only one small craft and others running several lines of steamers provided with all the conveniences of the day.

DEVELOPMENT OF TRANSPORTATION.

The development of transportation in Washington, during the brief period since its discovery and settlement, forms one of the most interesting chapters in the history of the Northwest. Fifty years ago the only "railroad" in the state was a short stretch of wooden rails on which goods were portaged around the cascades of the Columbia. Pioneers moved their supplies by canoe and saddle or along the Sound and on the Columbia by barge and schooner. In 1875 a short railroad was built from Walla Walla to Wallula, the wooden stringers of which were covered with rawhide, but the hungry coyotes ate up the rails and put the road out of commission for the winter. In 1880 the state had less than 300 miles of railroad. In 1917 it had 7,412 miles of steam main line trackage and 1,089 miles of electric railway, while the Indian trails have been replaced by more than 40,000 miles of public roads and highways.

STEAM RAILWAYS.

In 1883 the Northern Pacific railroad reached Puget Sound via Spokane and the Yakima valley, giving the State of Washington its first rail connection with the eastern states. With its many important branches, including lines to Walla Walla, through the Big Bend country, to Grays and Willapa Harbors, to Portland and the Canadian boundary, besides many supplementary feeders, it has about 3,000 miles of track. The Great Northern enters the state at Spokane and proceeds to the Sound country by way of the Wenatchee valley. It also has many im-

portant branches, including one to Oroville via the Colville and Okanogan valleys, one to Vancouver, B. C., and another to Portland, making, with its sidetracks and feeders, about 1,800 miles over which it operates. The Chicago, Milwaukee and St. Paul crosses the wheat belt of the state from Spokane, taps the Kittitas valley, penetrates the Cascade range to the Sound, and extends from there to Grays Harbor and the Olympic peninsula. This line has altogether 1,142 miles of trackage in the state. The Oregon-Washington Railroad and Navigation Company radiates from Walla Walla to Spokane, up the Yakima valley to Yakima and down the Columbia to Portland, whence it reaches Puget Sound and Grays and Willapa Harbors, operating over about 1,500 miles of trackage. The Seattle, Portland and Spokane railway follows the north bank of the Columbia into eastern Washington and penetrates the Inland Empire as far as Spokane. The Canadian Pacific and Soo lines operate over Great Northern and Northern Pacific tracks to the Sound country and the Canadian Pacific and the Chicago, Burlington & Quincy into Spokane. It will thus be seen that in effect the State of Washington is served by seven transcontinental lines. In addition, the Grand Trunk terminus at Prince Rupert, B. C., is connected with Seattle by special steamers.

ELECTRIC RAILWAYS.

The abundance of cheap hydro-electric power has caused a rapid development in electric railway transportation and some of the steam roads are now electrifying portions of their lines. These electric systems have grown from a few miles of street railway in the larger cities to interurban systems connecting centres many miles apart. In eastern Washington Spokane is connected with all the neighboring towns, with southeast Washington and northern Idaho, while the cities of Walla Walla and North Yakima are closely linked with the tributary agricultural sections for many miles.

In western Washington, Bellingham, Everett, Seattle, Tacoma and the Harbor cities all have interurbans, and it is felt that the day is not far distant when these will be connected up with the cities of the Willamette valley and British Columbia

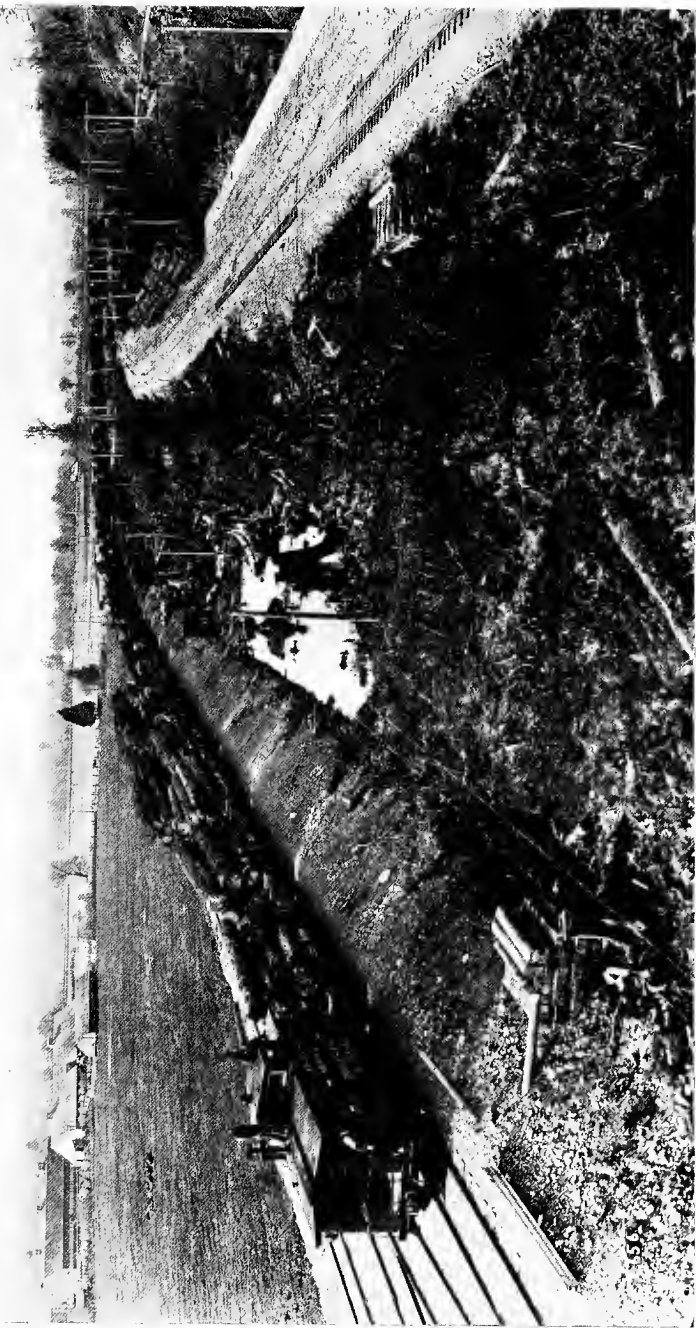
by electric interurban extensions, as well as by steam railroads and the other modes of transportation already existing. At present twenty electric companies operate systems totaling over 1,000 miles of trackage.

HIGHWAYS AND MOTOR VEHICLES.

Of additional importance is the motor vehicle. Hard surfaced or macadamized roads in many sections have facilitated the use of motor trucks and automobiles for freight and passenger service. This has proved especially valuable to sections of the state not yet reached by railroads and which are without the advantages of water transportation.

Twenty-three primary and secondary state highways, with a total length of 3,293 miles, built by state funds, extend to almost every part of the commonwealth. These include the Pacific highway from British Columbia south along the east shore of Puget Sound to the Columbia river, the Sunset highway from Puget Sound over the Cascades to Spokane, the Inland Empire and Central Washington highways through Eastern Washington, the McClellan Pass, via Rainier National Park, connecting with the Inland Empire at Yakima, the Olympic highway circling the Olympic peninsula, and the National Park highway from Mount Rainier to Southwestern Washington. While some of these highways are not yet entirely completed, good grades have been established and many miles of them have been graveled or hard surfaced, affording magnificent tourist routes among the beauty spots of the Northwest and commercial arteries into which pour the varied products of the state. These state highways are supplemented and fed by thousands of miles of county roads in varying stages of improvement, making a total of between 40,000 and 50,000 miles of highway in the state.

No state in the Union has taken more seriously the matter of extending its highway system and improving existing roads. A special levy is assessed in every county. At the present time from all sources an average of \$7,000,000 per annum is available for road work in the state and a similar sum, according to present plans, will be available for some years to come. Part



Thirty-two cars of logs on their way to the mill where they will yield more than 300,000 board feet of lumber.

of this is spent for new highways and part for the maintenance of those already built. Large amounts are also spent annually by the federal government for roads within the national forests, and additional sums from the Post Road Aid Fund are used in co-operation with the state.

This state system of trunk roads is so arranged that its principal arteries become a part of the national thoroughfares entering the Northwest, connecting with the Evergreen Highway, the Oregon Trail, the Pacific Highway, the National Parks Highway, the Yellowstone Trail and the Canadian highways from Winnipeg and Edmonton to the Coast.

The position which the automobile has attained in Washington as a means of transportation is shown by the fact that during the ten months' period from March 1, 1917, to January 1, 1918, there were issued by the Secretary of State 100,042 licenses for motor vehicles.

WHARFAGE.

Closely connected with the subject of transportation is that of wharves and docks which occupy an important place in the commercial activity of the state owing to the large amount of traffic carried on by water. There have been reported to the Public Service Commission a total of 134 docks and wharves, some on the Columbia river, others on the harbors of the southwestern part of the state, but most of them located along Puget Sound. These range in size and importance from the tiny landing, over which passes the trade of some rural community, to the mammoth municipal and private docks of the large cities over which vast cargoes are loaded onto ocean steamers.

TELEGRAPH AND TELEPHONE.

Allied also to transportation are the express, telegraph and telephone companies, all of which are well represented in Washington, there being of telephone and telegraph wire a total of 12,843 miles. Five express, six telegraph and 162 telephone companies are in operation, thus bringing almost every section of the state into direct and immediate communication with any part of the civilized world.

CHAPTER V.

COMMERCE AND MARKETS.

Other things being equal, the growth of any section as a manufacturing district will be in proportion to its facilities for commerce and the availability of markets for its products. The strategic position of Washington, already alluded to, extends the range of possibilities for its commercial development to an almost boundless degree. Possessing many ports where "rail meets sail" on Puget Sound, Grays Harbor, Willapa Bay and the Columbia river, and being served by the great transcontinental railways, which, connecting with vessels engaged in transoceanic and coastwise trade, bring the cities of all parts of the state into direct communication with ports across the sea, it is prepared both by nature and by human accomplishments to reach out to the entire world for the interchange of raw materials and manufactured goods.

Full realization of the promised development has been interfered with temporarily on account of the European conflict beginning just at the time when great things were expected from the opening of the Panama Canal, with a result that very little benefit has as yet been derived from that, the greatest engineering feat of a century. As soon as normal shipping conditions are restored, the vast benefits from this waterway will surely be felt and regular lines of water transportation will be established between the ports of Washington and those of the Atlantic and Gulf coasts; with eastern South America as well as with the principal European markets.

Even with such handicaps, the commercial growth of Washington has been phenomenal. The commerce of the Washington port district has become the greatest on the Pacific Coast and is rapidly increasing. In 1914 the total value of the merchandise exported through the Washington customs district was \$55,012,215 and of merchandise imported, \$55,391,565. The corresponding figures for 1916 were of exports, \$162,772,872, and of imports, \$135,580,910. These figures, however, are only for such goods as are subject to duty or excise in accordance

with the United States revenue laws. More representative of what actually passed through the ports are the figures of the various port wardens. Such figures are not available except for the cities of Seattle and Tacoma. These are quoted on account of their significance to the entire state, but it should be remembered that Spokane and other eastern Washington cities are equally responsible for such business in proportion to their population or the goods which they produce or utilize.

The Seattle port warden's report shows that imports of all classes through that port for the year 1916 totaled \$259,559,106, while the exports totaled \$152,879,213, the entire gain in both imports and exports over 1915 being \$154,645,926. This enormous total of \$412,438,319, however, has been largely exceeded in 1917, and while definite figures are not available because of federal restrictions due to the war, the estimate is placed at \$550,000,000 for the year. The Tacoma report for 1916 also indicated big increases over 1915, imports amounting to \$105,039,748 and exports, \$107,349,871, the entire gain over the previous year being \$118,138,002. The trade of this port for 1917 also shows a large growth, the total value reaching almost \$260,000,000, the estimated increase over 1916 being about 26 per cent. Domestic trade was carried on by water with Alaska, California, Hawaii, Baltimore, New York, and the Philippines; while foreign commerce included Australia, Africa, British Columbia, Denmark, England, France, Greece, Holland, India, Ireland, Italy, Norway and the Orient (including all Asiatic countries), Scotland, Siberia, South America, Spain, the Straits Settlements, Sweden and Switzerland.

EXPECTATIONS.

With such heavy traffic under present conditions when many ports are closed to our commerce, it is encouraging to contemplate what proportions will be reached when at the close of the international conflict these ports are again thrown open; when the short route through the Panama Canal permits Pacific Coast companies easy access to the Atlantic trade; when the stupendous development in prospect for Russia and the Orient begins to

be realized; and when an awakened America has recognized the value of a merchant marine to carry the trade of the continent on all the seas.

THE WESTERN GATE.

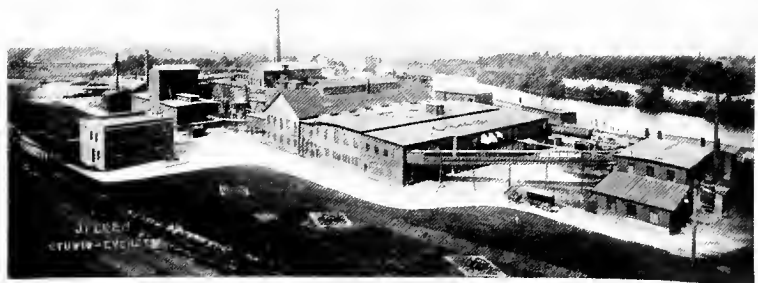
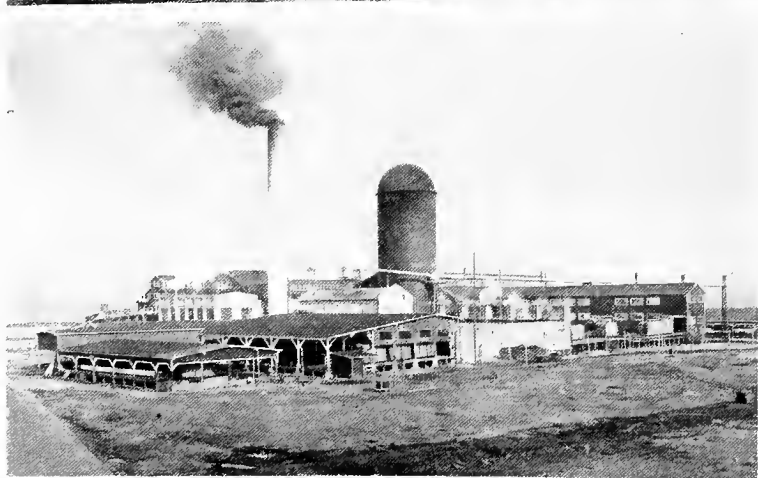
In a remarkable little book, "The Western Gate," published in 1911, Patrick H. W. Ross, the author, traces the ethnological and geographical reasons for the development of the great trade centers of the world and submits that what he styles "the Maritime District of Western Washington" is so situated as to become the greatest commercial center of the Western Hemisphere. He compares it as to location, climate, harbor facilities, and transportation possibilities, with Great Britain, and says:

"Given the chance to follow the line of least resistance, the Baltic, (*i. e.*, seafaring) race in the Western Hemisphere will make of its Baltic habitat in Washington a state as populous, as rich and as powerful in that hemisphere as England is in the Eastern Hemisphere and nothing can stop that development, once it is understood and unimpeded and encouraged by the people of the United States. The conditions for opening a great world port there are perfect beyond comparison."

THREE KINDS OF MARKETS.

Markets for the manufactured products of Washington may be considered under three heads—local, domestic and foreign. All of these are available in a greater or less degree, depending upon the nature of the product. As an example, take the case of our greatest industry, lumber. Much of the product of the mills, particularly the smaller ones, is consumed locally in the communities directly adjacent to the mills. In fact there are some mills which cut lumber only for the local trade.

Other mills maintain lumber yards in their own or adjacent cities, but dispose of most of their product in the eastern markets, shipping by rail to various points in the United States. Other mills, located along deep water, ship practically all their products to foreign countries on steamers or "windjammers" which ply between the ports of Washington and other lands. During 1916, Washington exported nearly three million dollars' worth of lumber to foreign countries. Much of this was un-



EVERETT INDUSTRIAL SCENES.

No. 1. Bay front, showing manufacturing section. No. 2. One of the largest and most modern lumber mills in the world; daily capacity, 750,000 board feet. No. 3. Everett Pulp & Paper Co.

dressed lumber and dimension timbers. In addition nearly two million dollars' worth of remanufactures or goods made out of lumber were also shipped.

Similar conditions prevail as to many other products, including condensed milk, canned fish, fruits, vegetables, flour, etc., certain portions of all of which are consumed locally and much more shipped to distant markets outside the state.

LOCAL MARKETS.

Then there are some lines of manufacturing whose products are no more than enough to supply the local markets and in many cases insufficient, so that many goods must be shipped in to supplement the Washington made goods; for it must be remembered that this state is comparatively new and a rapid growth is taking place. Many new immigrants make their homes here each year and those already located are rapidly improving their own financial circumstances and increasing their demands for additional articles of various kinds. Modern methods of farming, clearing of logged-off lands, the opening of large areas to irrigation, and the development in mining and fishing are all important contributing influences toward the rapid upbuilding of local markets for the goods of our own manufacturers. On the other hand, these same forces increase the supply of raw material for existing and new industrial plants.

DOMESTIC MARKETS.

Domestic markets, of course, are markets under the flag of the United States. These include all the United States proper, Alaska, Bering Sea, Hawaii and the Philippines. Of the neighboring markets, Alaska is at present by far the most important to the State of Washington. A special chapter is devoted to its discussion; but it is pertinent to note here that Washington is not just the gateway to Alaska; this Empire of the North depends on Washington for many of its supplies and a large part of its trade has been directly with the industrial plants and jobbing houses of this state.

Many classes of manufactures, particularly lumber and dairy and other agricultural products, are afforded a good market in the middle and eastern sections of the United States. A very large proportion of the lumber and shingles produced in Washington is marketed throughout the central states and much of the condensed milk, canned fish, fruits and vegetables also finds its way to these sections. Flour and grain products from Spokane, Walla Walla, Yakima and other eastern Washington cities are largely shipped by rail to the great eastern markets, but detailed figures on rail shipments are not obtainable.

Some idea of the present domestic commerce of the Northwest by water may be gathered from the following items of export through the port of Seattle, for 1916, bearing in mind that proportionate shipments were also made from Tacoma, Everett and Bellingham, as well as other smaller cities on the Sound and Harbors, and that much of this originated in Spokane, Yakima, Walla Walla and other east of the mountain sections:

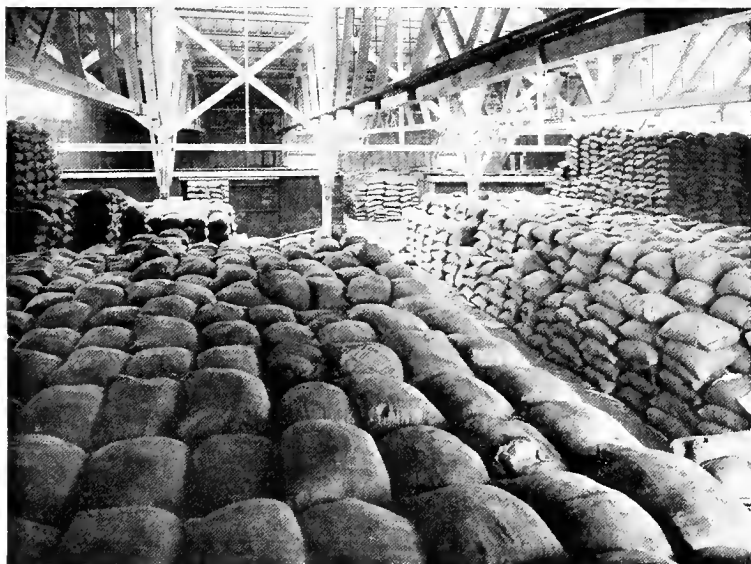
	Butter	Cheese	Canned Milk	Flour
Alaska	\$369,820	\$64,832	\$304,549	\$229,369
Bering	114,512	17,179	93,546	120,987
California	9,000	26,400	1,194,425	2,893,686
Hawaii			53,212	120,286
Philippines			38,387	478,618
Totals.....	\$493,332	\$108,411	\$1,684,119	\$3,842,946

The larger part of the above items, besides numerous other varied products, was presumably produced in this state. In addition, many goods not extensively manufactured in the state, if at all, are also shipped from Washington ports: such as hardware, machinery, nails, paper, rubber goods, structural steel, explosives, etc. The total volume of domestic commerce passing through the same city by water in 1916 was as follows: Alaska, imports, \$36,169,415, exports, \$21,930,038; Bering Sea, exports, \$3,706,846; California, imports, \$33,227,770, exports, \$13,275,573; fishing banks, imports, \$1,303,287; Hawaii, imports, \$649,672, exports, \$1,063,447; Philippines, imports, \$8,858,151, exports, \$2,384,536; local points, imports, \$17,046,598, exports, \$14,339,466. Tacoma, Everett and Bellingham

also handled large volumes of this business for which segregated figures are not available.

FOREIGN MARKETS.

Unnatural conditions throughout the world have probably affected our foreign trade more than any other branch of our commerce, so that it is difficult to present any conclusive data of recent origin on the subject, since our principal foreign markets at present are confined chiefly to trans-Pacific lands. These



Rice in transit (through a Tacoma warehouse).

markets, to be sure, are very important and will rapidly increase in importance, since they belong to countries which, like the Northwest, are just beginning to be developed. Washington is so situated that it should derive the greatest benefit from the vast amount of commerce which will result. Its ports, by the great circle method of navigation, are nearer to Siberia, Japan and China than are any other American cities. Already Japan is a large consumer of American-made goods, and an awakened China is calling for a constantly increasing quantity of Occi-

dental improvements and, with her enormous population, offers a remarkable field for commercial effort. The vast plains of Siberia have possibilities of a development similar to that of our own West; when political upheavals have subsided and a liberal governmental policy opens it to settlement and intensive cultivation, it will become one of the principal markets for American products.

Then, too, other Asiatic ports, Australia, South American countries and British Columbia are all reached more readily from Pacific Coast ports than from either the Atlantic seaboard or European continent. One of the works being taken up by commerce and trade bureaus is the study of such trade and the ways in which we can best prepare for it. When the future value of all this is fully realized it may be readily understood why the chances for Washington ports and consequently for Washington-made goods are so favorable.

STATISTICS OF FOREIGN TRADE.

The rapidity with which the commerce of America with Asiatic countries has grown during the past two years can be seen from the report of the U. S. Bureau of Commerce. In the first ten months of the fiscal year of 1915, the total exports to Asia were \$91,259,248; imports from Asia, \$201,355,226. During the same period for 1917, the exports were \$324,230,432, while the imports were \$465,219,192. In this, two things are conspicuous, the large increase in the total commerce with Asia and the increase in the ratio which the exports bear to the imports.

As an indication of what the foreign trade has amounted to during the past year, figures are again quoted from the report of Seattle's port warden, the same ratio probably existing in the business of the other ports: Australia, imports, \$8,079, exports, \$121,645; British Columbia, imports, \$12,795,152, exports, \$6,092,123; England, imports, \$77,207, exports, \$3,180,575; India, imports, \$3,689,992, exports, \$74,466; the Orient, imports, \$117,040,771, exports, \$39,991,660; Siberia, imports, \$711,880, exports, \$44,667,886; South America, imports, \$144,276, exports, \$826,638; Straits Settlements, imports, \$26,659,465, exports, \$1,002,526.

Of these figures, those showing our exports to Siberia and to South America seem especially significant, the former as illustrating the magnitude of the trade already developed with this vast region which offers such a profitable field for the future, and the latter as showing how little is being done in the Northwest to gain the trade of the Latin nations of the southern continent. Of the total to South America, nearly \$700,000 was for wheat, rice and flour, leaving only a little more than \$100,000 worth of manufactured goods. On the other hand, most of the largest items representing trade with Siberia were for manufactured goods, including autos, box cars, dry goods, explosives, leather products, machinery, rubber goods, saddlery and twine, each of which ran to more than one million dollars.

TRADE IN TRANSIT.

Many opportunities for the manufacturer are revealed by the quantities and varieties of exports and imports passing through our ports. Naturally much of the exported merchandise does not originate in the State of Washington, but is shipped to our ports by rail from many widely separated points. The same is true as to the destination of the imports.

In the case of many articles, the query arises, why could not the manufacturing be done as cheaply here near the seaboard, and the long, transcontinental haul be thus saved. For instance, more than twenty-one million dollars' worth of crude rubber was imported last year through two ports, while nearly a half million dollars' worth of rubber goods was exported through the same ports. This does not include the amount consumed on this coast. On all of this, freight had to be paid two ways across the continent.

More than \$700,000 worth of boots and shoes were shipped from one Washington city last year, and yet only a small portion of them were manufactured in this state, although more than \$2,000,000 worth of hides passed through this same city. Nearly a million dollars' worth of wool was imported through Seattle and fully as much woolen goods and garments was exported through the same port. Seven million dollars' worth of block tin was imported from Asia by way of one Washington port and shipped by rail to Pittsburgh or other eastern points,

where it was rolled and shipped back to this coast in enormous quantities, more than \$3,000,000 worth of tin plate having been exported over Washington docks.

Many similar instances might be cited where raw material actually passes through local ports en route to the manufacturing centers of the East, while the finished products are hauled back across the continent and shipped to foreign ports or sold in the markets of Alaska and the western states.

It would surely pay the manufacturer of such articles as these mentioned, as well as of many others, to investigate still further the trade conditions that make such long freight hauls necessary in order to supply certain sections with the articles they need. Many of these could be just as well manufactured in Washington and the amount saved in freight would be of great help in bidding for the markets demanding such articles.

OPPORTUNITIES FOR BUILDING UP TRADE.

Washington manufacturers do not have to depend on the unsolicited demand for their goods. Splendid chances exist for building up markets, both domestic and foreign. One way is by using every possible care in the packing of goods for shipment. It is stated that one reason for our splendid trade with Alaska lies in the fact that our merchants have eagerly met the demands of the market. Attempts to rob them of this trade have been defeated in a great measure because merchants elsewhere have not taken the same pains to cater to it. For example, all goods destined for Alaska, particularly for points in the interior, "are packed with special reference to the distances to be traversed, the numerous handlings which must be had and the means of transportation generally."

CAREFUL SHIPPING IMPORTANT.

The experiences with Alaska should be taken into consideration by manufacturers who aspire to the trade of China, Russia, South America and other districts, foreign or domestic. The consular reports from various countries record many complaints against careless packing and the independent attitude of American supply houses, and show also that Germany and England have been able to retain the South American trade



INDUSTRIES AT YAKIMA.

- No. 1. A \$75,000 ice and cold storage Plant. No. 2. A \$185,000 cannery.
 No. 3. Fruit and vegetable evaporator. No. 4. Apple evaporator.
 No. 5. A \$400,000 lumber mill with 35,000,000 feet annual capacity.

during the past principally because of the indifference of American manufacturers, who too often have assumed the attitude that if foreign customers did not want the kind of goods they made, shipped as they wanted to ship them and packed "any old way" they didn't have to take them.

A careful study of the particular demands of such export markets will result in the development of a vast volume of commerce for the industries of the state. Foreign peculiarities must be taken into consideration and the need of meeting their peculiar requirements cannot be too strongly emphasized. Special conditions of transportation, climate, etc., must be studied by the manufacturers who wish to derive the full advantages of these foreign markets. But in the end such efforts will surely pay well.

JOBGING CENTRES.

Wholesale distribution is one of the factors also to be considered by many manufacturers who do not sell direct to the consumer or retailer. In this instance, too, Washington offers excellent facilities. The cities of Seattle and Tacoma in western Washington and Spokane in eastern Washington, besides Portland, Oregon, which for practical purposes serves much of the State of Washington equally with Oregon, are large jobbing and wholesale centres; while Walla Walla, Yakima, Wenatchee, Bellingham, Everett and Grays Harbor are smaller distributing points of considerable importance. Retail stores carrying all lines of goods are well represented in every city and town, so that local distribution offers few difficulties.

READY MARKETS.

Taken as a whole there are few sections in the United States where the market facilities offered to manufacturing industries equal those of Washington. While it is true that every variety of manufactured product is subject to its own peculiar difficulties of marketing, so that no general or limited discussion can be expected to provide specific information or point out the best means of disposing of any particular product, nevertheless, prospective manufacturers may feel assured that in this state they will find such conditions exceptionally favorable and readily adaptable to the individual needs of every establishment.

CHAPTER VI.

ALASKA'S RESOURCES.

BY J. L. McPHERSON,

Manager of Alaska Bureau, Seattle Chamber of Commerce and
Commercial Club.

Alaska, equal in area to twelve states the size of New York, offers to Washington and the Northwest a trade territory that has no equal. It probably possesses a greater variety of natural resources than any like area of our land. These embrace mineral deposits of gold, silver, copper, iron, tin, antimony, tungsten, lead, graphite, cinnabar, platinum, molybdenum, marble, gypsum, barytes, and coal and oil; the most extensive fishing banks in the world; a fur industry, land and aquatic, that has produced over \$76,000,000; kelp fields of great extent; agricultural and grazing lands of an estimated area of 100,000 square miles; enormous areas of reindeer pasture land and a large supply of timber suitable for aeroplane frames and paper pulp products; a water-power that insures a great industrial development; and scenery, unsurpassed, that will make the northland a tourist Mecca.

AREA, POPULATION, AND COMMERCE.

This land of great resources, of inestimable wealth, is situated in the same latitude as Norway, Sweden and Finland. Climatic conditions are similar. It has an area a third greater than these three European countries, which have a population of about eleven millions and can in no wise compare with Alaska in variety, extent, or value of resources. Alaska's population is only about 75,000, probably not to exceed 50,000 of whom are whites. Its commerce in 1916 reached a total value of \$110,368,592. No country in the world's history has ever made such a showing, which is all the more remarkable because it has been limited, with few exceptions, to those regions that can be reached by water transportation. Its greater development awaits the construction of the necessary railroads and wagon roads that will open up the vast hinterland of the interior. With

such facilities there will come about a progress in development that will be unequalled by any other land.

GOLD PLACERS.

Gold placers have been found throughout all sections of the north and had produced by the end of 1916, \$196,800,000. The wide distribution of these deposits assures a great gold quartz industry which, until the present time, with one or two minor exceptions, has been confined to the deposits adjacent to tide-



Alaska's area equals one-fifth that of continental United States or 12 times the state of New York. It would reach from the coast of Georgia to the California coast and from the Dominion of Canada to the Mexican border.

water. The Treadwell mines have produced in excess of \$56,000,000 and in the same belt are two other mammoth producers, the Alaska-Gastineau and Alaska-Juneau, which are today mining and milling over 9,000 tons of ore daily, with ore resources blocked out that assure operations for many years. These mines have established the world's record for low cost of mining and milling; the total cost per ton at the Alaska-Gastineau mine for 1916 being only 73 cents, mining operations in this belt having been reduced to a basis of cost attained only in manufacture.

COPPER.

The great extent of Alaska's copper deposits cannot be estimated. During 1916, eighteen copper mines were operating, situated in three widely separated belts, Prince of Wales island in southeastern Alaska, Prince William sound in southern Alaska, and Chitina in the Copper river interior. These mines in 1916 produced 135,289,219 pounds of copper valued at \$35,-314,993. The great Kennecott mine in the Chitina district produced over 120,000,000 pounds, ranking fourth in production among the world's copper mines and first in low cost of production; the Kennecott cost of production being only $4\frac{3}{4}$ cents per pound as compared with 7 cents for Utah and 11 cents for Calumet and Hecla.

ANTIMONY, IRON, AND MARBLE.

The mining of antimony, commenced in 1915, has produced \$253,635, and tungsten mining, commenced in 1916, had a value for that year of \$83,370.

Large deposits of iron ores have been discovered, deposits of magnetite in southeastern Alaska, hemetite on the Seward peninsula and chrome ore on Kenai peninsula. Extensive deposits of graphite are under development in the Seward peninsula region. Deposits of lead and silver ore are being developed in southeastern Alaska. A deposit of cinnabar has been mined on the Kuskokwim. Platinum, molybdenum and other valuable metals have been discovered in various regions.

The marble deposits of southeastern Alaska are now furnishing the marble used in the construction of buildings throughout the western cities. These deposits are stated to rival both in extent and quality the famous marble deposits of Vermont. Gypsum, used for plaster of Paris and as a land fertilizer, is being mined on Chichagof island. Barytes, used in the production of white lead, is being mined on Prince of Wales island.

COAL AND OIL.

The coal deposits of Alaska range in quality from lignite to anthracite and have been estimated by the U. S. Geological Sur-

vey to embrace a greater tonnage than originally contained in the state of Pennsylvania. The semi-bituminous coal of Alaska is the most suitable coal for steaming purposes to be found in any country bordering on the Pacific. Until recently, the mining of Alaska coal has been prohibited. A leasing law is now in effect which provides for the development of this industry on which depends in great part the industrial development of Alaska.

Oil has been discovered in three widely separated belts, but as was the case of the coal deposits, all development is prohibited. The Yakataga-Katalla belt extends for a distance of over a hundred miles. The oil in this belt is of a paraffine base and before the order of government withdrawal had gone into effect, title to one claim had been granted. The production from the wells on this claim is being refined on the ground and the output disposed of in the nearby communities of Cordova, Valdez, Seward and Anchorage.

FISHERIES AND FURS.

The fishing industry of Alaska exceeds in value of output all of our Pacific Coast states combined and yet the development of this industry can be said to have only commenced. It has been stated by the U. S. Bureau of Fisheries that there are in Alaskan waters approximately 250 varieties of food fish. It is estimated that the value of this industry for the year 1917 will exceed \$40,000,000. The continental shelf, extending around the entire shore of southeastern, southern and western Alaska, is probably the greatest fishing ground possessed by any country.

The prohibition by the government of the killing of fur seal is resulting in a gradual increase in the number of the seal which annually visit the Pribilof islands. The seal are now estimated to exceed 350,000, but the protective measures now being enforced will result in building up the herds to something like their former numbers, which at one time was estimated to total approximately five million.

The gradual decline in the land fur industry will in time be overcome through the development of the domestic fur industry.



Famous Kennicott copper mine, Alaska. Much of the wealth of this rich territory flows through Washington's trade channels.

Many fur farms have been established throughout the northland for the raising of fox and other fur bearing animals.

AGRICULTURE.

The agricultural possibilities of Alaska are probably greater than those of the combined Scandinavian countries. It is estimated that Alaska contains 100,000 square miles of land suitable for cultivation or grazing, when cleared. This is an area equal to two times that of the state of New York. Of this probably 15,000 to 20,000 square miles are suitable for intensive cultivation.

REINDEER.

The herds of reindeer in Alaska now number in excess of 90,000 head. This industry was started in the years 1897 to 1902 by the importation of 1,280 reindeer from Siberia. The reindeer grazing lands of Alaska, which are situated in the western and northern parts of Alaska, are unsuitable for agricultural development and are estimated to provide pasturage for at least ten million reindeer. The raising of reindeer, both as a source of food supply and for various by-products, promises to become a large and valuable industry.

SPRUCE TIMBER.

Alaska spruce is now being extensively used in the manufacture of aeroplane frames, for which purpose it is pronounced the most suitable timber available. The use of this timber also for paper pulp products assures a large and valuable industry. It is estimated that the forests of southeastern and southern Alaska contain in excess of eighty billion feet of merchantable timber. The amount suitable for paper pulp purposes is probably far greater.

RELATION TO WASHINGTON.

The State of Washington is the gateway to this great Land of the North and can rightfully be expected to supply many of the demands of its growing population and to receive in return from the rich natural resources of this territory, many of the raw materials required for its industrial development.

CHAPTER VII.

WATER POWERS IN THE STATE OF WASHINGTON.

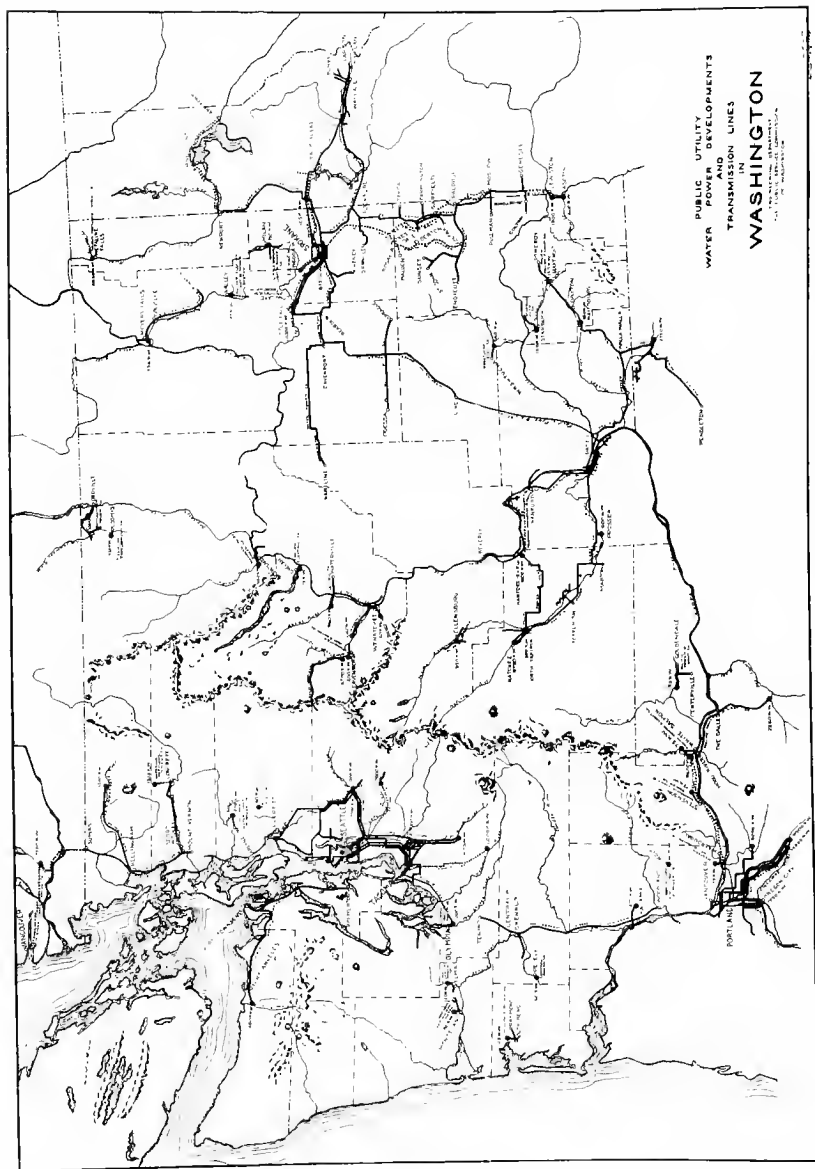
BY W. E. HERRING,

Industrial Agent, Puget Sound Traction, Light & Power Company.

The relation of power to manufacturing is as the engine to a freight train. Without it all other elements are of no avail. It is important too for practical purposes that it be abundant and cheap. The sources of the cheapest available power thus far known to the world are the falls and rapids of the rivers and mountain streams. In these Washington is richly endowed, for it has more undeveloped water power within its boundaries than any other state in the Union. Government figures as to the minimum potential power in the United States show a total of 26,736,000 horse power, and of this amount 4,932,000 horse power is available within the State of Washington. The state ranking next to Washington in this respect is Oregon, where 3,278,546 horse power is available, so that nearly a third of all the potential water power in the United States is in the two states, Washington and Oregon.

NATURAL CONDITIONS FAVOR VAST POTENTIAL POWER

The natural causes for such vast quantities of available power are the heavy precipitation and rapid fall in the streams entering the ocean on the one hand and the extensive area drained by one of the largest rivers on the continent, and its tributaries on the other. The precipitation in the Olympics and on the west slope of the Cascade mountains averages 90 to 100 inches per annum, which, coupled with numerous falls, affords many almost ideal opportunities for water power plants. On the east side, the mighty Columbia river along with several important tributaries carries the drainage of a territory five times that of the entire State of Washington, and in the heavy flow of water over cataracts, falls and rapids brings the total of available water power on the east side almost up to that produced by the higher and more frequent falls of the west side.



Existing hydro-electric plants and lines over which 300,000 H. P. is distributed.

IMPORTANT RIVERS.

Among the most important rivers in addition to the Columbia having potential water power are the Spokane, the Snake, the Pend Oreille, the Methow, the Chelan, Yakima, Wenatchee and Klickitat on the east side, and the Skagit, Stillaguamish, Skykomish, Snoqualmie, Cedar, White, Puyallup, Nisqually, Skokomish, Elwah, White Salmon, Lewis, Toutle and Cowlitz on the west side.

DEVELOPED POWER.

While the electrical industry as a whole is increasing at a tremendous rate in various parts of the country, the Pacific Coast has experienced a greater increase in water power development within the last few years than any other section. Yet of all the vast potential power, the total amount developed in Washington is now only slightly over 300,000 horse power. Conditions are rapidly changing, however. Since many new industries have sprung up during the past twelve months and many more are now being established, it has become necessary to increase also the amount of power available.

LARGEST POWER COMPANIES.

The Puget Sound region, embracing that portion of the western part of the state extending from Olympia to the British Columbia line, a distance of approximately 175 miles, is covered by the transmission lines of the Puget Sound Traction, Light and Power Company, with total assets of approximately eighty million dollars and with approximately 151,000 horse power installed in its various plants. The next largest company is the Washington Water Power Company of Spokane with a total installed capacity of 108,250 horse power. The Pacific Power and Light Company with plants scattered through the Columbia river basin has a total installed capacity of 22,100 horse power and supplies the entire Columbia river territory, extending almost to the eastern limits of the State of Washington. On the west side of the mountains and extending southerly from Olympia to the Columbia river is the North Coast Power Company with a total rated capacity of 3,087 horse power.

SMALLER POWER COMPANIES.

Throughout the balance of the state are numerous smaller plants which practically supply the needs of every small community in the state.

The following are the larger plants of this type:

NAME	Territory Served	K. W. Rating of Generators
Lewiston-Clarkston Improvement Company.....	Asotin.....	1,900
Northern Washington Power and Reduction Co....	Republic.....	675
Hanford Irrigation & Power Company.....	Columbia River Valley...	1,800
Okanogan Valley Power Company.....	Methow River.....	630
Olympia Light & Power Company.....	Olympia.....	1,000
Olympic Power Company.....	Port Angeles.....	6,000
Wenatchee Valley Gas & Electric Company.....	Wenatchee.....	1,180

In addition, the Great Northern Railway has a 6,000-kilowatt development on the Wenatchee river, all of which is used in operating their trains through the Cascade tunnel, which was electrified about nine years ago.

The Superior Portland Cement Company has approximately 1,500 kilowatts which it uses in its cement plant and the Inland Portland Cement Company has 3,500 kilowatts, all of which is used in the manufacture of cement.

COST OF ELECTRICITY IN WASHINGTON.

The cost of electricity to the consumer is less in Washington than in any other part of the United States. That it is so can readily be understood when it is known that the electric companies are selling current even to coal mines and to lumber mills for their entire operation.

Coal is mined in several parts of the state and there are numerous producing mines within a few miles of tidewater. Competition with cheap coal from these mines and with lumber refuse from the mills has had to be overcome. In the lumber mills the only practical way of getting rid of the refuse is by burning and so it has been the practice for the larger mills, in order to utilize some of this, to generate their own power. While in the past, steam drive in the lumber mill, transmitted by means of pulleys, belts and shafting, was considered the proper thing, more modern practice dictates that freedom from

fire, increase in efficiency and better results can be obtained by electric drive. Hence, many of the more modern mills have adopted this type of drive.

Comparative figures obtained from users of large blocks of power in various places have shown that the rates made in this section are materially lower than elsewhere. This condition will unquestionably have an influence in inducing large users of



Tacoma's Nisqually power plant dam at intake.

power to locate in this territory. It is realized, to be sure, that in the majority of industries the cost of the power used represents a very small percentage of the cost of the finished product; but in those selected industries where the cost of power amounts to from 40 to 60 per cent. of the cost of the finished product, the matter of power rates is a very important one.

HISTORY OF POWER DEVELOPMENT.

The growth of the Pacific Coast states is so well known that not more than passing mention need be made of it. In the ten

years from 1900 to 1910, the ever increasing demand for electric power could not be met by the operating companies. They were compelled to increase the size of their existing plants, construct new plants and even resort to the construction of steam plants to supply the demand made upon them.

The earlier types of construction for water power plants are not the recognized standard of construction at the present day, but at that time they fulfilled the purpose admirably, with certain exceptions which are now so well known. Lack of storage facilities was one of the common causes of inability to supply the constantly increasing demand for electric power and this was overcome in some measure by the construction of steam auxiliary plants to tide over the peak period. The later hydro-electric developments, however, provide for ample storage facilities which will obviate to a great extent these steam relays; particularly is this true where more than one water power plant feeds into a common transmission line. With only one such plant the steam relay is needed to guarantee continuity of service, but with several water plants it is not so essential. As a result of this earlier development, large and expensive steam auxiliary plants were provided, which with some of the companies are now practically a dead investment, so far as their revenue producing capacity is concerned; as a measure, however, of guaranteed continuity of service they are worth the money invested.

INCREASING CAPACITY.

Up to perhaps 1910 the operating companies had much difficulty in obtaining the capacity needed for the demand upon their plants. By the spring of 1916 conditions had changed to a certain extent and the markets had become more nearly saturated with power, while no new demands of any magnitude existed. Forecast curves made as late as 1910 by various operating companies showed an average annual increment that seemed to prove that much greater capacities would be needed in the next few years. Now, it is not possible for a public utility company to wait until the demand for power arises before constructing its plant; it is necessary to look ahead a few

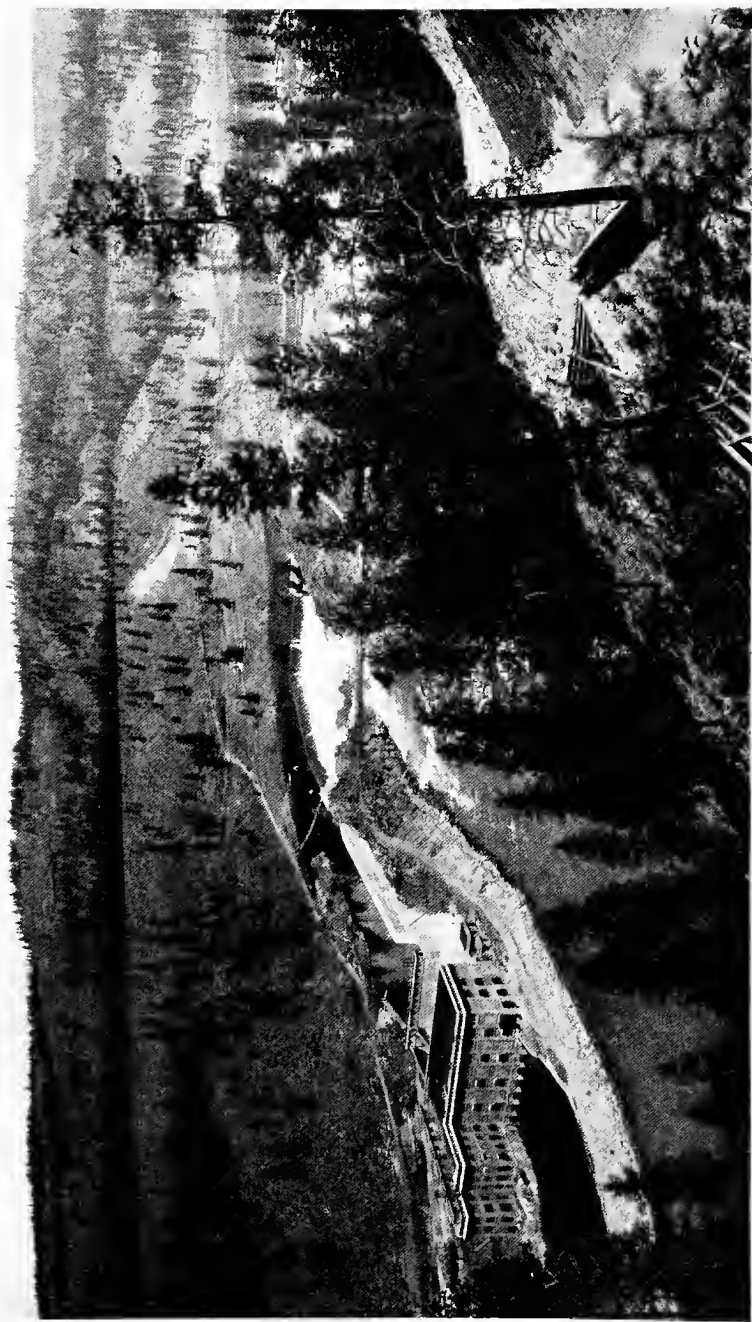
years and estimate as closely as possible the power that will be required and provide that capacity before the time arrives. Following this procedure, the various companies provided additional capacities and made arrangements for new plants to take care of the load which they expected to have in the succeeding years, but up to the spring of 1916, due to the fact that these curves did not follow their upward trend, but flattened out, practically all these companies found that they had a surplus of power. Since the spring of 1916, however, especially in the western part of the state, a large number of new industries, particularly shipbuilding plants, have been constructed which required an enormous amount of additional power so that the company operating in this territory is now compelled to increase its capacity by 35,000 horse power in order to take care of the rapidly growing load.

AN IMPORTANT COMPARISON.

As a matter of information, statistics show that one-fourth of the entire generating capacity of the United States is used by one-seventeenth of the country's population here in the West and that this same population is contributing one-seventh of the aggregate income of the electric lighting industry. On an average, every person in the West uses 527 kilowatt hours annually and pays \$7.50 for light and power as compared to the 99 kilowatt hour consumption and the \$3.00 contribution of the population east of the Rockies.

One explanation for this lies in the fact that public utility companies in this state as elsewhere recognize the interdependence of the industries and the companies which serve them; so it behooves them to use every effort to utilize every advantage which abundant water power can offer, in order that they may be in a position to supply plenty of electrical energy at a minimum cost to the consumer.

Thus it is clear that to whatever extent manufacturing depends upon cheap power, this state is well fortified not alone in potential water power, but in the amount developed and available or in process of development.



Power plant at Little Falls. Electrical power generated here is carried to Spokane and distributed for city lighting, street car service, manufacturing and domestic use.

CHAPTER VIII.

SOME APPLICATIONS FOR CHEAP POWER.

The abundant power described in the foregoing article is susceptible of many important industrial applications in addition to those already being made by existing factories in this state. The comparatively new fields of electro-metallurgy and electro-chemistry afford a great variety of operations.

Among the electro-chemical processes now known and which could probably be carried on successfully in Washington are electro-alkaline manufacture, by which chlorine, caustic soda, hydrogen and sodium-hypochlorate are produced; various nitrogen fixation processes, by which nitrogen is extracted from the air and manufactured into nitric acid, commercial fertilizer or other products; and the production by means of electric furnaces of such materials as silicon, peroxides, metallic magnesium, metallic phosphorus, or such artificial abrasives as carborundum, alundum, aloxite or crystolon.

Discussing this phase of electrical development, C. E. Borgardus, a prominent chemical engineer of Seattle, says:

“Electricity is at present a dominating factor in the metallurgical field. It is responsible for the commercial use of aluminum and the electrolytic deposition of zinc on a commercial scale has also been accomplished. In tin, electricity is being used two ways, electric smelting and electrolytic refining. But the electric furnace has made its greatest achievement in the production of some of the rarer base metals and making them available for commercial use where they were not used before, making possible molybdenum steel, vanadium and tungsten. It has been the ambition of the electro-metallurgist to replace the blast and crucible furnaces with the electric for the production of pig iron and steel.

“With the use of the electric current a proven success in the chemical world and a strong factor metallurgically, it follows that this work will be done where there is abundant water power with natural resources. Washington, I think I can safely state, will furnish more water power for hydro-electric purposes and cheaper than any other place in the United States.

"Many manufacturers who use electricity have their eyes on Washington and as soon as the war is over and the money market adjusted, will locate here. A great many are negotiating at present. One large company which has found a big alunite property, is planning to build in Washington and manufacture aluminum and make potassium sulphate for fertilizer. Then Niagara will not be the only center for aluminum. Niagara has been called 'the laboratory of the country.' Washington will be called the factory.

"At a not very distant date you will see in Washington electric iron and tin smelters which will supply all the iron, steel and sheet tin for the Pacific Coast and the Orient. You will see a large electric copper smelter and refining works, also nitrogen fixation plants for nitric acid and cyanamide and other chemical plants using electricity. In fact, Washington will be the greatest state in the Union in electro-chemistry and electro-metallurgy."

Some of the special opportunities which exist for manufacturing plants using hydro-electric power are indicated in the following quotation from a letter written by G. E. Gates, Spokane resident agent of the General Electric Company. Although these words have special reference to the Spokane country, much said would naturally apply to any part of the state in which cheap power exists:

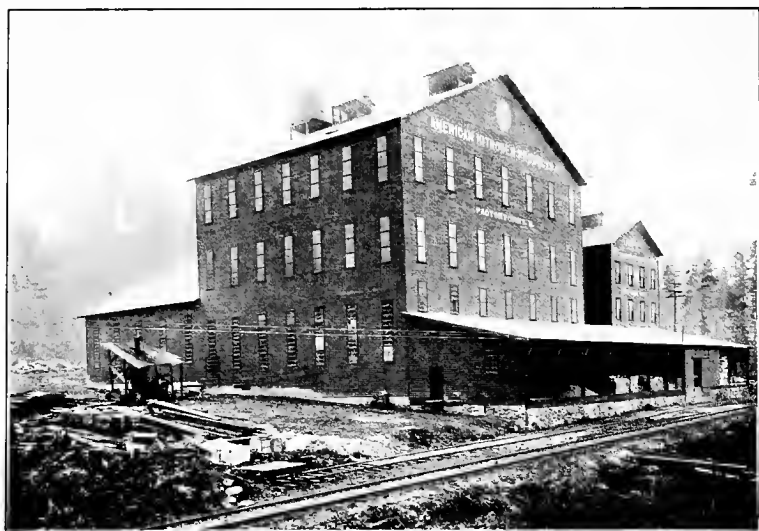
"It has always occurred to me that the Inland Empire is in a position to offer great inducements to any manufacturing industry in which the process is such that the demand for power will be large and the per cent. paid for power as compared with the other manufacturing costs will be found to be high, such, for instance, as the manufacture of ground wood pulp; the manufacture of electrolytic zinc and other electro-chemical processes, such as ferro-alloys, etc.

"In the manufacture of ground wood pulp, power, which is a very large item in the manufacturing expense, is being purchased and can be purchased at reasonably low rates, especially when provisions can be made for manufacturing in what is known as 'off peak load' of the power company—the requirements of this being ample storage facilities for ground wood pulp so as to carry over the period of peak loads of the power company when the grinding could not be carried on. In addition to this we have, immediately tributary to Spokane, several varieties of wood, which it has been proven by actual results, are well adapted to the manufacture of ground wood pulp.

"Spokane is located centrally for large zinc producing districts such as are found in southern British Columbia and the Coeur d'Alene mines, and by operating a customs electrolytic precipitation plant in or near Spokane and adjacent to one of the large hydro-electric developments or possible hydro-electric developments, the precipitation plant could call on zinc from a number of sources. The electrolytic process is a comparatively new one, but has now been in operation on an extensive scale for a sufficient length of time in such cities as Trail, Anaconda and others, to prove its success.

"With the large supply of both lead ores and pig lead which is available in this district there should be a field for the manufacture of arsenate of lead, for which there is a large demand locally.

"In the fixation of nitrates, large amounts of power are required and the success of the commercial fixation of nitrates is dependent solely upon power being available at a reasonable rate. Unlimited power is available in the Inland Empire and can be furnished at a reasonable rate. Furthermore, the Inland Empire is located far from the seaboard so that a site for a nitrate plant should appeal to the government from a militaristic standpoint and being located in a large agricultural district the product of such a plant should find a ready market for commercial purposes."



Nitrogen fixation plant at La Grande, utilizing surplus current from Tacoma's municipal power system.

CHAPTER IX.

LUMBER—ITS MANUFACTURE AND RE-MANUFACTURE.

Timber ranks first among the present natural resources of Washington. From the snow-tipped summits of the Cascade Mountains to the wave-lapped shores of Puget Sound and the Pacific Ocean, there once stretched an unbroken belt of the world's most wonderful forest, while down the east slope of these mountains and eastward across the northern counties, a lighter growth of good timber extended. The inroads of agriculture and the birth of cities with their commercial aspirations have caused the clearing of a considerable portion of this area, but there still remains the largest body of standing timber in any state except Oregon. The giant firs and feathery cedars of the west side and the murmuring pines of the east side lift their heads high into the azure sky and offer material for the state's most extensive industries.

COMPARATIVE FIGURES.

The unlimited resources and the exceptional facilities for logging and transportation of the logs to the mills, which the many waterways of this state afford, have caused the timber business to be developed with such remarkable rapidity that Washington now leads the world in the production of lumber, which commodity forms its most important article of manufacture and commerce. In one year alone its sawmills cut 5,105,925,000 feet of lumber and its shingle mills manufactured 9,370,750,000 shingles. For the past ten years its annual cut has averaged about four billion feet, board measure. Its shingle output is about three-fifths that of the entire United States and its stand of red cedar is more than that of all the rest of the Pacific Northwest.

In 1914 there were 821 saw and shingle mills employing 36,461 men and producing lumber valued at \$78,130,000 per annum. These mills range in size from small local plants employing perhaps a half dozen men and cutting a limited amount of rough lumber for local use, to plants employing four or five hundred men. Some of these largest mills have a daily capacity

of between 300,000 and a million feet. The warehouses for some of these largest hold from 20,000,000 to 50,000,000 board feet. It is interesting to note that an eastern company desiring 4,000,000 feet of lumber within 30 days found a Grays Harbor firm the only one in the United States that could fill the order on such short notice. Four days after it was given, a special train of 29 cars started with the first delivery of 1,000,000 feet. More than a hundred cars were required to carry the full amount.

VARIETIES OF TIMBER.

The principal varieties of trees found in Washington are the Douglas fir, cedar, hemlock, spruce and western pine. These constitute about 97 per cent. of the merchantable timber. In smaller quantities are found larch, maple, ash, alder and a few other woods of limited use. The most heavily timbered area of the state lies west of the Cascade Mountains, but there is also found in some sections of eastern Washington excellent pine and a small quantity of fir, cedar and tamarack. According to a government report for 1914, of 294.6 billion feet of privately owned timber in Washington (outside the national forests), 270.5 billion feet was growing west of the Cascades and only 24.1 billion feet east of this range. Classified as to variety, the amount of privately owned timber in the state, in billions of board feet, was as follows: Douglas fir, 193.6; white pine, 0.7; western pine, 12.5; cedar, 37.0; hemlock, 33.0; spruce, 8.9; all other species, 8.9.

DEVELOPMENT OF LUMBERING INDUSTRY.

The development of the lumber industry in this state began as a localized business with small mill companies owning and logging their own timber and supplying the demands of the community or shipping the product by water. The growth of rail transportation and the improvements in mechanical equipment have made possible larger milling operations, and concentration to a certain extent. The very nature of the industry, however, sets a limit on this concentration and the small mill not only pioneers the field but comes back after the large mill is "cut out."



WASHINGTON LEADS THE UNITED STATES IN LUMBER PRODUCTION.

No. 1. Logs in boom. No. 2. Loading lumber. No. 3. A few "toothpicks."
No. 4. Graded and stored awaiting shipment.

TRANSPORTATION IMPORTANT.

Transportation facilities are particularly important in connection with the lumber industry on account of the large bulk and weight in proportion to the value of the logs and lumber. Since much of the log is waste there is a great saving in sawing it into lumber comparatively near to its point of origin. In the Puget Sound district a large amount of timber stands close to cheap water transportation, so that it can be logged and rafted at the minimum cost to any one of the numerous mills distributed along the water front. In many other sections, however, lumbering depends on moving a small mill from place to place or else transporting the logs for considerable distances to some of the larger mills.

SIX BRANCHES OF INDUSTRY.

Taken as a whole, the lumber industry comprises six more or less distinct branches, with only three of which, the second, third and last, this chapter purports to deal. These are:

(1) The ownership of the standing timber, which must often be held over considerable periods before it can be marketed.

(2) Logging, or cutting the trees into logs or bolts and delivering them to the mills, often requiring transportation over considerable distances by rail, driving or towing.

(3) Manufacturing the logs into lumber, including its seasoning, surfacing, and finishing into special forms.

(4) Wholesale lumber distribution, which bridges the gap between the sawmill and the retail lumber yard, wood-using factory or other large consumer.

(5) Retail lumber distribution, which places the bulk of the product in small lots in the hands of the consumer; and

(6) Re-manufacturing lumber and timber products into various classes of wooden goods.

LOGGING.

Standing timber, in general, is first cut and handled by the logging camps which fell the trees and work them up into sawlogs, shingle bolts, stave or heading bolts, poles, mine timbers, spars, ship-knees, piling, posts, hewn ties, and handles, excelsior

or pulp stock. In the case of most of these products, the logging camp is but the first stage in their conversion into manufactured commodities. Logs and bolts go to the mills and the other stock to the factories. Mine-timbers, poles, posts and ties may be used as they come from the camps. Ship-knees are sometimes hewed into shape, but more often dressed at the mill. Cedar bolts are sawed in shingle mills into commercial shingles and baled, ready for the market. Heading and stave bolts usually find their way directly to the cooperage plants. Other stock is worked up into handles, excelsior, or pulp and paper without any intermediate operation.

SAW MILLS.

By far the largest portion of Washington's timber passes through the saw mills and planing mills, where it is sawed, planed and trimmed into the various classes of rough and dressed lumber. In some cases the planing mill is a part of the saw mill and at other times it is a separate institution. Some of the larger mills even re-manufacture to a certain extent, but most of the lumber is sold locally or shipped in the usual commercial forms.

There are still some openings for saw and shingle mills in the state near railroad lines or spurs or waterways. One of the main considerations would be the securing of a sufficient body of timber or log supply to warrant the expense of putting in the mill, most of the timber outside the reserves and not on state lands being already in the hands of private parties who in many cases wish to saw it themselves as fast as the market demands it or capital can be secured, although often they are willing to sell to a reliable mill company. Portions of that in the reserves or on state lands is sold at intervals to the highest bidder and a certain time allowed to remove it.

The reports received as shown on page 213 indicate that fifty places are requesting saw mills and twelve desire shingle mills.

PRINCIPAL RE-MANUFACTURES.

It is quite natural that a state which produces so much timber should support many establishments which are engaged in the work of re-manufacturing some of this lumber into certain

useful and necessary articles. Yet when it is considered that there are nearly one thousand saw mills in the State of Washington, turning out annually over four billion feet of lumber valued at more than seventy-five million dollars, it will be seen that the establishments for wood re-manufacture are comparatively few. The most important ones are those that make the furnishings for houses, and other buildings. There are at present forty companies engaged in the manufacture of sash and doors, mouldings and other house furnishing articles. One of the big veneer plants in the state occupies a building a quarter of a mile long, in which 6,000 doors are manufactured each day of 22 hours—said to be a larger daily output than any other plant in the world.

A list of the products of one of the largest factories includes fir sash, fir doors, fir window frames, fir colonial columns, balusters, porch work of all kinds, stair work, paneling, inside finish, three-ply panels, furniture stock and mouldings. According to the reports on page 213 there are nine communities requesting sash and door factories. These would undoubtedly merit investigation by the interested person.

FURNITURE.

An industry which offers excellent possibilities in the state is furniture manufacturing. This industry uses the greatest variety of wood and utilizes large quantities of scrap lumber that would probably go to waste. The manager of one of the principal concerns says: "We use all kinds of fir, some cottonwood, ash, maple and alder. Only fir and ash show the slash grain and are sold as fir and ash furniture. Other woods have no figure in grain and are used for cores, drawer bottoms, backing and for enameling. We utilize all lengths. Only defects and edgings go into fuel bins. We saw from logs all so-called hard wood used, but buy the fir lumber. Very little, however, is so-called merchantable stock, for what we make takes short lengths. We can use cut-offs from the saw mills and in this respect make use of much material that would be and generally is sent to fire-hold or burner."

Fifty or more furniture factories are at present operating, but there is room for additional ones, as so much of our furni-

ture, especially office furniture, is shipped from without the state. As many as ten communities are asking for such establishments and it seems certain that this many and more ought to succeed if properly located and managed by experienced men.

The articles manufactured here at present include dressers, beds, commodes, tables, chairs, kitchen cabinets and many other items.

BOXES.

About fifty different concerns in the state are engaged in manufacturing boxes, including box shooks, bottle boxes, wooden packing boxes, crates for butter, fruits, berries and vegetables,



A big lumber mill at Spokane, daily capacity 300,000 feet.

egg cases and cases for canned goods, etc. Most of these factories are able to use short length lumber and work up their product so as to have little waste. The manager of one company states: "We are using the lumber up very closely. One small item is cleats, size $11\frac{1}{2} \times 3\frac{3}{4}$, of which we manufacture about eight million each year. We also manufacture many small boxes, using for some parts of the box narrow strips either matched together or fastened with steel corrugated fasteners, in this manner using up a large number of scraps and cull lumber that we accumulate."

During the past season box factories have been hard pressed in their efforts to supply the demand, which is particularly keen, especially in the fruit districts, on account of the heavy yields of all kinds of fruits. Twenty-four communities have expressed a desire for such factories, which in many instances would serve

the double purpose of utilizing short pieces of wood and also of providing shippers with the necessary shipping equipment.

MISCELLANEOUS WOOD RE-MANUFACTURES.

Among other lines of re-manufacture of lumber and timber products, at present followed to a greater or less extent in this state, are wood-stave pipe, silos (3 companies), matches (2 factories), cooperage (7 plants), incubators (3 factories), cross-arms, gutter, broom and mop handles, violins and musical instruments, excelsior, and wood pulp. Among the items produced by the cooperage plants may be mentioned barrels, hogs-heads, lard tubs, pickle pails, jell-pails, fish pails, fish kits, butter tubs, candy pails, vinegar and meat kegs. Stave silos and water tanks are manufactured in considerable quantities and there is a growing local demand for them. Wood-stave pipe is also becoming an important product. It is manufactured in both the creosoted and uncreosoted forms. Undoubtedly there are openings for additional manufacturing in these and other allied industries, especially if managed by men of business ability. Among other miscellaneous plants requested and not already mentioned are broom, cooperage, silo and general wood-working establishments.

One correspondent from eastern Washington suggests that there is an opening in the Spokane district for the manufacture of sleighs and logging sleds, which could be supplied more cheaply than they can be purchased in the east.

Four factories in this state are manufacturing ladders and stepladders and it seems that from the large demand existing for these articles, especially in the fruit districts, there might be opportunities for further development along this line. Another correspondent is of the opinion that some of the lesser known native woods might be used in various ways, suggesting that the manzanita is especially adapted to the making of "briar" pipes.

Excelsior manufacturing also has many possibilities, there being but one plant in the state at the present time. Cottonwood, of which there are unlimited quantities, is used chiefly in the production of this commodity.

DISTRIBUTION OF EXISTING SAW AND SHINGLE MILLS

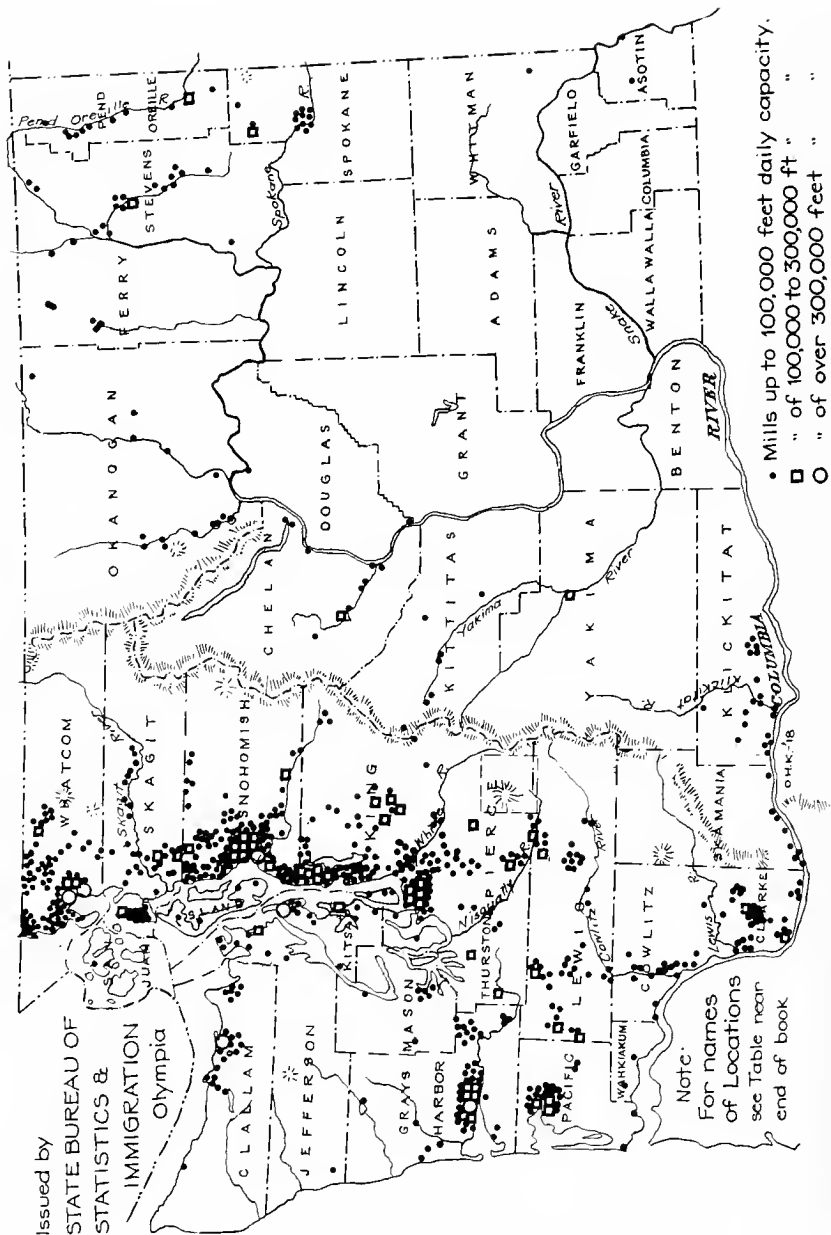
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STATE BUREAU OF

STATISTICS &

IMMIGRATION

Olympia



Note:

For names
of Locations
see Table near
end of book

- Mills up to 100,000 feet daily capacity.
- " of 100,000 to 300,000 ft " "
- " of over 300,000 feet " "

WOOD WASTE UTILIZED.

In addition to re-manufacturing from merchantable timber, the problem of successfully utilizing the waste material from the mills and logging camps is very important. This opens up a large field for investigation and abundant opportunity for new industries. Prof. Benson, in the article following, calls attention to the fact that only about 32 per cent. of the lumber as it stands in the forest is at present utilized in any manner and suggests a number of uses to which this could be put by chemical processes. Other uses also have been mentioned already in connection with furniture and boxes.

This waste includes large quantities of short length lumber, narrow strips, slabs, edgings, knotty pieces and sawdust, much of which could be utilized in the manufacture of various useful articles requiring lengths of that sort and adapted to the utilization of cull lumber.

Although some of this waste is cut into slabs and sold for fire wood, yet by far the largest quantity is burned up immediately at the mill producing it. Most of the mills maintain huge "burners," into which all unmarketable material is carried automatically by an endless chain conveyor, thus keeping the great fire going day and night. These "burners" appear in the distance like great towers or lighthouses. One of the largest mills in the state, with a daily capacity of over 700,000 board feet, burns up between a thousand and twelve hundred cords every day in a huge "burner" 64 feet 8 inches in diameter and 106 feet high, which would represent in the neighborhood of a million feet of timber waste in one mill alone.

Of course arrangements would have to be made with the concern producing this waste before action could be taken for its utilization, but in most cases that would not be a difficult thing to do.

MISCELLANEOUS USES FOR WASTE.

There are many uses to which this waste could be put. Among other suggestions for the utilization of much of the short length and scrap lumber, and one which offers an attractive field of investigation for enterprising woodworkers possessing some imagination, is the making of novelty wood articles

and wooden toys. One man suggests: "A quantity of this surplus that is now being burned could be used for chair stock, pails, barrels, dowell-pins, carvings, all kinds of novelties, etc., but more than all combined it would make the very thing that is now so high and difficult to get as wanted, paper or paper pulp. This Northwest should take a lesson from Norway, Sweden and Canada. We are burning up what they turn into cash."

One idea which seems practical is that "an organization or company could be formed, which would maintain what might be called an assembling station, with the object of setting up several different articles of furniture, toys or anything that may be made of scraps that usually go to the fire room or woodpile, drawing this material from the various mills and factories which could supply parts of several different articles but could not furnish all the parts of any one article."

SAWDUST AND SCRAPS.

One of the biggest items of waste is the sawdust, one mill man stating that "an ordinary circular saw takes out nearly three-eighths of an inch, which means a loss of about one-third on every inch board cut." When additional loss in planing and trimming is considered, the net quantity of merchantable lumber from a log is less than one-half. Some way may be found to utilize most if not all of this lost material. The United States government experts in the Forestry Products Laboratory, after an exhaustive investigation of sawdust disposal, have completed a list of fifty different uses to which this material could be put, among the most important being manufacture of linoleum and artificial woods, certain kinds of wall papers, briquettes and in packing.

The utilization of any or all waste for the generation of power is of course always feasible, if there are factories located near enough to its origin. It has been suggested by several mill men that if there were a sufficient demand for electrical power near their mills, they could easily increase their boiler and dynamo capacity and produce this power very cheaply by burning in their furnaces much of the sawdust and scrap that is now wasted or burned on the slab-pile. By such means, woodworking

plants located near them might secure both material and power at a minimum cost.

One correspondent voices this idea in the following words:

"We ask that you give serious consideration to the matter of advising new industries of the possibilities of obtaining cheap power where they can be located in the close neighborhood of saw mills, particularly those that are driven by electric power. We think mills that are electrically driven have more fuel than they can possibly use under their boilers and are obliged to make heavy investments in refuse burners, etc., to dispose of surplus fuel. This waste will in most cases amount to more than the actual fuel consumed and if a market for the power could be obtained to warrant the investment in the additional boiler and power equipment, this power could be furnished very cheaply indeed to other factories. It appears to us that there should be a great development along this line and we will be glad to be put in communication with any factory concern to whom you think this would appeal."

PAPER AND WOOD PULP.

Just a word should be said regarding paper and wood pulp which has been touched on in a number of other places. Time and again it has been said, by men in a position to know, that the north Pacific Coast is to be the centre for the pulp and paper industry during the next few years. The woods suitable are hemlock, spruce, cottonwood and fir, each of which is found in unlimited quantities in Washington. One correspondent says:

"If it is true, as I understand it is, that hemlock pulp can be successfully utilized in the manufacture of paper, this would seem to be an opportune time to encourage the location of those experienced in paper manufacture in an enterprise of this kind. There is a vast amount of this wood in western Washington, much of which cannot be utilized in ordinary lumber operations, in consequence of which it is left in the woods to be destroyed by fire.

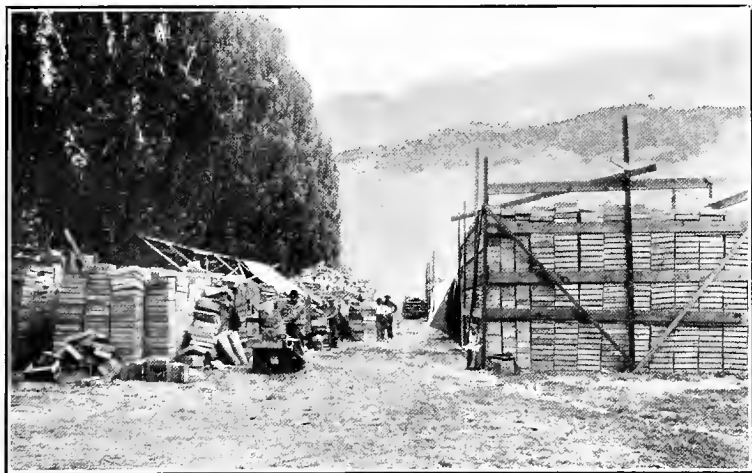
"I believe if your department can manage to reach individuals informed on the production of paper from wood pulp, with information as to the adequate supply of material, the ease with which it can be secured, and the relative cheapness of power, that a great deal can be added to the wealth of our commonwealth from this one industry alone."

At the present time there are four plants in the state with several additional ones being located, while fifteen communities are requesting plants in their vicinities.

A LARGE VARIETY OF OPPORTUNITIES.

In conclusion, then, it may be said that there are opportunities for practically every line of manufacturing which depends upon the wood of the forest for its raw material, no matter whether it be for the construction of those articles requiring the choicest lumber that can be bought or merely the inferior pieces or scraps that in many cases are at present being wasted, and ranging all the way from million dollar ships down to boxes that sell for a few pennies.

Although the increasing cost of labor and the accumulating cost of holding timber land make it unlikely that the price of lumber will ever again be as low as it has been in the past, yet, when all conditions are considered, there is probably no section anywhere to be found where the opportunities for lines of endeavor depending for their chief raw materials upon lumber or timber products are so generally favorable as in the timber regions of the State of Washington.



ASSEMBLING BOXES AT THE ORCHARD.

The demand for boxes is annually increasing and many communities report openings for box factories.

CHAPTER X.

THE BY-PRODUCTS OF THE LUMBER INDUSTRY.*

BY H. K. BENSON,

Director of the Bureau of Industrial Research in the
University of Washington.

In a general way it is safe to say that an average of only 320 feet of lumber is used for each 1,000 feet that stood in the forest. This shrinkage is due to a variety of causes, such as loss of bark, sawdust, edgings and trimmings, slabs, carelessness in manufacture, loss due to standarizing lengths and widths, defective trees, broken logs, tops and limbs, etc. In considering the possibilities for industries dependent on wood for other uses than lumber, the supply may be obtained from (1) forest growth that is non-merchantable for lumber purposes, (2) logging waste and (3) saw mill waste. In this article only a brief survey of the industries which might be established by the use of species found in the state will be undertaken.

STEAM DISTILLATION AND EXTRACTION.

Where a constant supply of highly resinous wood such as Douglas fir or the western yellow pine can be obtained, the production of turpentine, pine oil and rosin can be undertaken. Such an industry exists in the South, where highly selected "light wood" (*i. e.*, very resinous) is used. The usual process is to chip the wood in a "hog," treat it with steam in a closed tank until the turpentine and pine oil vapors are driven off and condensed, forming a top layer of oil in the distillate. The chips in the still are next covered with a solvent such as gasoline or engine distillate which dissolves the rosin. This solution is next distilled for the recovery of the gasoline, and the residue, consisting of molten rosin, is run into barrels where it solidifies in cooling. The extracted chips are commonly used for fuel only, furnishing all the steam required in the process. Douglas fir is not sufficiently rich in oils to make it profitable to utilize common run saw mill waste or stumps, but its yields when especially selected are comparable to those obtained in the South. At the present time the industry would undoubtedly be profitable.

* For a fuller discussion the reader is referred to Special Agents' Series No. 110, Bureau of Foreign and Domestic Commerce, U. S. Department of Commerce, Washington, D. C. Price, 10 cents.

WOOD DISTILLATION.

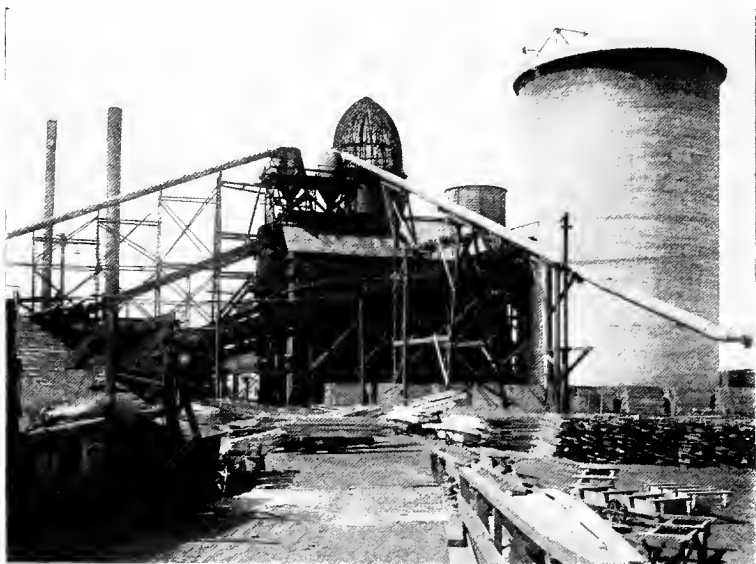
Instead of treating the chips with steam, cord wood or slabs may be placed in closed retorts or ovens and heated externally for 24 hours, yielding light oil (crude turpentine), tar, charcoal, gas, and a watery distillate from which wood alcohol, acetone, and acetic acid may be obtained. This is a large industry, utilizing hardwoods and producing alcohol, acetone, acetate of lime, and charcoal as its main products, the gas and tar usually being burned as fuel in the process. From Douglas fir and pine, the yield of products in the watery distillate is not large enough to warrant this recovery and the merchantable products will therefore consist of light oil (from which turpentine and pine oil may be obtained by refining), tar, charcoal, and gas. One commercial plant at Auburn is now operating as a gas company. A good market exists for wood tar and oils in the flotation processes in mining, but the charcoal market is uncertain and seemingly dependent upon the development of electro-metallurgical processes, not yet in operation on a commercial scale. The industry is fairly well established in the South, utilizing the highly selected (resinous) long leaf pine.

TANNIN EXTRACT.

In normal times the United States produces only about one-half of the extract required for tanning. The bulk of domestic extract is made from chestnut wood, although hemlock and oak bark are extensively used in tanneries making their own extract and to some extent in extract plants. The content of tannin in chestnut wood is about 6 per cent. The bark of the Douglas fir contains about the same quantity. Selected slabs of fir, especially in mills using considerable hemlock, would serve as a profitable source for tannin. The western hemlock bark is now used as a source of tannin and contains about 14 per cent. of tannin. The western yellow pine and larch barks are also rich enough in tannin to warrant their utilization. The remoteness of the Pacific Coast from the large tanneries of the East is the only deterring factor in the establishment of the industry. The process is comparatively simple, consisting of chipping or shredding the bark, leaching with hot water, and concentrating the liquor to suitable concentration for shipment.

WOOD PULP.

Washington is rich in species suitable for the manufacture of wood pulp. Spruce, cottonwood, and fir are now largely used in the mills in this and adjoining states. Considerable slab wood is used in the East and recently several mills have been built in the South to operate on pine slabs alone. One of the difficulties of utilizing saw mill waste is in removing the bark from the irregularly shaped pieces, instead of the round forest wood gen-



A huge burner, 64 feet, 8 inches in diameter and 106 feet high, burning waste lumber at a Gray's Harbor saw mill. Will consume 1200 cords of wood each day.

erally used. Barking drums have been successfully used and when it is remembered that the bark is rich enough in tannin for the manufacture of extract, the cost item should not be considered prohibitive, provided that a tannin extract plant is accessory to the pulp mill.

The use of wood pulp for articles other than paper deserves recognition, especially in the manufacture of insulating conduits and fibre articles which are now only obtainable from the East.

PRODUCER GAS.

Mention has already been made of the manufacture of gas from wood by distillation. By the use of the gas producer, a

cheap fuel is obtainable for the operation of gas engines and for firing ovens in the ceramic, glass and chemical industries. One large concern in the South is entirely operated by gas engines using producer gas made from cypress mill waste. This plant produces its power at a total cost of only \$0.225 per horse power hour and has found the installation highly satisfactory in every respect. The utilization of mill waste in this manner deserves wider recognition.

ETHYL ALCOHOL.

Sawdust may be treated with sulphuric acid in closed digesters under steam pressure, whereby a portion of it is converted into sugar. This may be fermented by the addition of yeast and ordinary grain alcohol obtained. This process has been successfully developed by the Dupont Powder Company at Georgetown, South Carolina, where the sawdust of three mills is completely utilized for alcohol manufacture. The process demands careful location as well as careful technical control to make it successful.

NEEDLE OILS.

The farmers of New England sell annually about \$100,000 worth of needle oils made by distilling the leaves or small twigs of such trees as cedar, hemlock, spruce, fir and pine. They use simple home-made stills and sell the oil to wholesale drug houses and exporters. The oils are used for the manufacture of medicines, perfumes, deodorizers, etc. The needle oil of the native red cedar has been used to a small extent in the manufacture of insecticides.

WOOD FLOUR.

Finely ground wood, usually spruce, is used as an absorbent for nitroglycerine in the manufacture of dynamite. At the present time, the dynamite plants of the state ship in from the East their supply of this material.

In conclusion it will be seen from this brief summary that no single plan of utilization seems to become general. A careful, specific study should be made of each plant and the method selected which seems most practical in a given case.

CHAPTER XI.

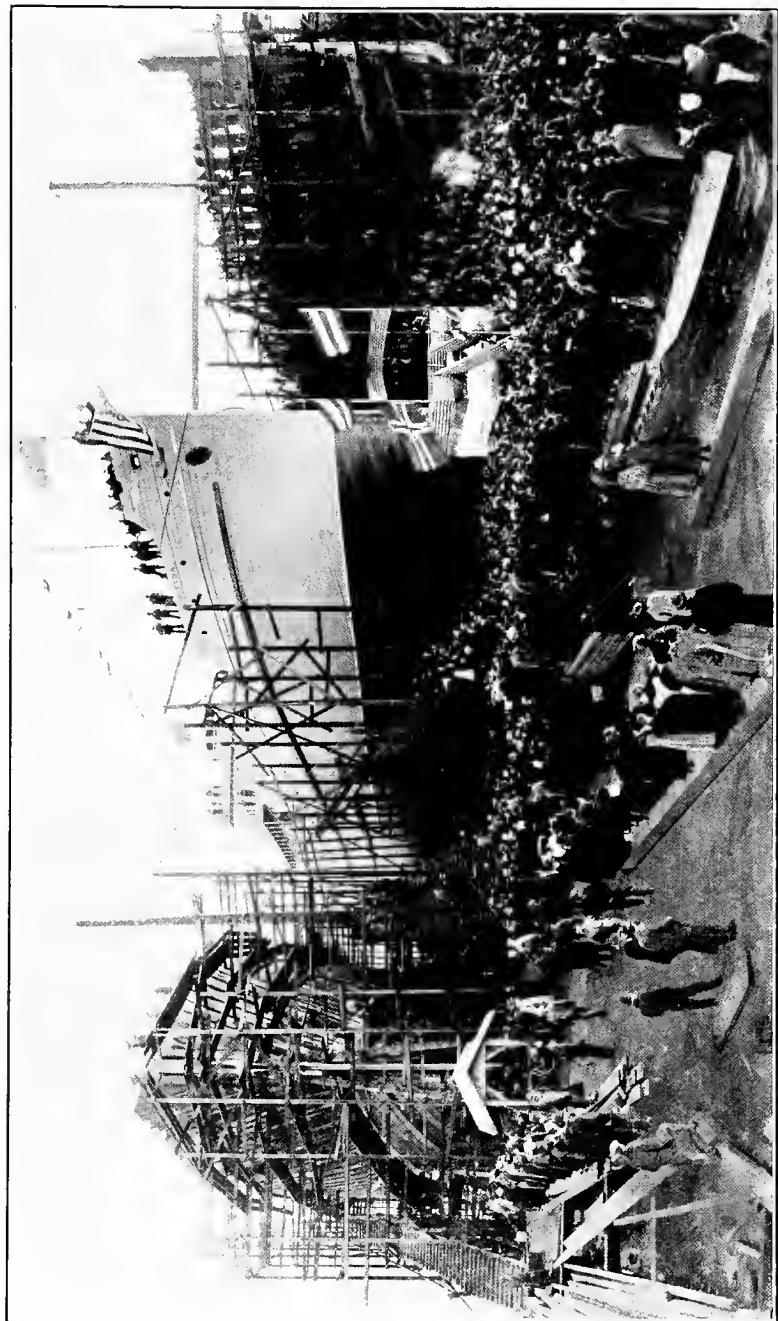
SHIP BUILDING.

No industry in the state has experienced so sudden and so rapid a development within the brief period of twelve months as ship building. While a few vessels both of wood and steel had been constructed in Washington yards prior to the European conflict, yet the industry as a whole was of minor importance, probably due partially to the general decline of the American merchant marine and to the high cost of steel on the western coast.

SUDDEN CHANGE.

The situation changed, as it were, over night. The wanton destruction of numerous vessels through submarine activities created an enormous and immediate demand for bottoms to carry supplies and munitions of war. The price of steel, to be sure, was still high everywhere and was steadily soaring; at that the supply was limited. On the other hand, the general demand for ships was becoming acute and had to be met. Then the question arose, why not wooden ships? Investigations were made. The enduring qualities of the hard, coarse-grained Douglas fir became known. It was learned, too, that on the hills of the State of Washington, overlooking great harbors and ideal sites for ship building construction, grew dense bodies of this and other timber well suited for this purpose, while huge mills with modern equipment were ready to saw this timber into any size or shape required.

The rest of the story is quite familiar. Men with a vision of the future and well supplied with capital came forward. The first of the new wooden ships were built in Seattle for a Norwegian company and several yards were soon started on the strength of the foreign business promised. Even before the United States declared war, wooden ship building had made a fair start and many contracts had been undertaken for foreign corporations.



Launching twin-screw steamer Abridged at Grays Harbor. First wooden vessel launched for U. S. Shipping Board Emergency Corporation.

UNITED STATES BECOMES INTERESTED.

Early in the spring of 1917 the United States shipping board sent representatives to the Northwest to investigate the possibilities for the speedy construction of a large number of vessels. A meeting was held with the lumbermen and shipbuilders in Seattle, April 4, 1917. The findings of that board were summed up in the statement of Theodore Brunt, its vice chairman, who declared that the board was fully satisfied that Douglas fir was perfectly adapted for ship building purposes and that the Pacific Northwest would be looked to on account of its unlimited supply of such wood to render invaluable service in carrying out the ship building program. About that time, April, 1917, the tug, J. D. Boyden, built 29 years before, was docked on Puget Sound; numerous holes were bored in her hull; every plank was sound.

Since then the growth of the industry has been so rapid that any data compiled on the subject would be obsolete in a few weeks. In almost every important industrial center located on tidewater, ship yards have been planned and ways erected, upon which may be seen vessels in various stages of construction. Many have been already launched and some are now bearing valuable cargoes upon the high seas. Seattle, Tacoma, Olympia, Bellingham, Anacortes, Port Angeles, Port Townsend, Aberdeen, Hoquiam, Raymond and Vancouver all have active yards.

STEEL SHIPS.

While the building of wooden ships in this state has been more widely distributed and is of prime importance because the principal material used is produced locally, the growth of steel ship construction has been no less remarkable and the prospects for its future development are equally bright. In the four steel construction yards of Seattle, 23 cargo ships with a local dead weight capacity of 201,200 tons were launched in 1917. Three war vessels were also launched and a large amount of repair work done on government vessels and sequestered ships. Several contracts for naval vessels have been awarded to Washington

private yards and the Puget Sound Navy Yard at Bremerton is being equipped for major construction. A large plant for steel ship building has just been completed in Tacoma and the tonnage produced next year promises to be vastly increased. As elsewhere stated, announcements have been made of the contemplated erection of large steel plants on Puget Sound, the completion of which will obviate some of the delays experienced in securing material from the East and should greatly stimulate this industry.

RECENT DEVELOPMENTS.

Something of the rapidity of the growth of ship building in Washington may be comprehended from the statement that in September, 1916, there were 2,160 men employed in the ship yards of the state, but that by September of 1917 the number had increased to more than 16,000 men. There were at that time altogether more than 130 building ways upon which vessels totaling in value nearly \$200,000,000 were being constructed. It is estimated that 26 per cent. of the shipping now being built in the United States is in the states of Washington and Oregon.

The principal types of wooden ships now under construction range in size from 2,500 to 4,000 tons dead weight capacity and from 250 to 390 feet in length. They cost from \$200,000 to \$500,000 each. One of these vessels requires from one to two million feet of lumber in its construction. The standard government vessel with a 280 foot keel, costing \$500,000, requires 1,622,637 feet, board measure.

In addition to the building of larger ships, there has also been a considerable increase in the construction of small boats, lifeboats, etc., several companies having found this a very profitable line of endeavor.

FUTURE OF SHIP BUILDING.

As long as present international conditions continue, the demand for ships will undoubtedly tax the utmost capacity of all yards on the Coast. But it is by no means expected that the demand will cease with the resumption of pre-war diplomatic relations. Even after international peace has been brought about, the commercial energies of this nation must for years be devoted to supplying the needs of European nations during the

period of reconstruction, and to furnishing certain merchandise to other countries whose usual sources of supplies will have been either depleted or else cut off altogether, for the United States has been said to occupy "the best business stand in the world," and is considered also the greatest workshop and manufacturing plant.

New and undeveloped lands will also be ready for closer business relations with this country. From the Rio Grande to the Straits of Magellan there stretches a vast trade territory as yet scarcely touched by American commerce. This land is rapidly increasing in population and offers a fertile field for development. Our trans-Pacific commerce, too, is capable of enormous increase.

To carry on this interchange of raw materials and manufactured products, a great merchant marine will be needed. Ships and more ships will be the cry. The United States already has the greatest system of rail transportation in the world, one that is well prepared to carry the rich products of its inland districts to the great ocean ports. The total trackage nearly equals that of all the rest of the world combined. It is inconceivable that after the experience of the past few years, any opposition will remain to the maintenance of a merchant marine of sufficient magnitude to properly supplement and coordinate with such splendid railroad facilities.

A SIGNIFICANT QUOTATION.

Of particular significance in this connection are the words of a prominent Tacoma citizen:

"What of the future of wooden ship construction? Will it cease when the present emergency has passed? About 30 years ago wooden construction was superseded because with a world commerce, small compared with the present, the steel mills and steel shipyards were able to supply ships of larger tonnage at low prices. In consequence, a steady evolution in steel vessels as regards design, size and speed took place, but little progress was made in wooden ship building. The situation is different now. Steel mills and steel shipyards cannot supply the present needs of the world. We have returned to wooden ships. Is it not reasonable to believe that from this year forward, there will

be a rapid development in the size, uses and possibly the speed of wooden ships?

"The evolution of steel construction in the Northwest, too, will continue. It seems a certainty that before next year the building of one or more steel plants will be under way in the Pacific Northwest. If Portland, Seattle and Tacoma can develop great plants for building steel steamships based upon the hauling of steel from the Atlantic seaboard, what may not be accomplished when the steel is produced here at home?"

EXISTING OPPORTUNITIES.

The possibilities for profitable investment in this business are further indicated by favorable replies from individual communities to a questionnaire from this office. Fifteen localities report openings for shipyards and nearly all of them offer free sites or other assistance. (See table, page 215.) In several of these, no yards have as yet been established, while in the others additional plants are recommended because the citizens there feel that they would be remunerative enterprises.

These sites are commended to the prospective shipbuilder for investigation and it is hoped that they will receive at least a careful consideration by those in a position to engage in this industry. Today an added incentive is present; an enterprise so important as ship building has become a patriotic duty for those who can engage in it and not merely a good business venture.



Steamship Seattle, the first steel vessel delivered under direct contract with the U. S. Shipping Fleet Corporation. Built in 78 working days.

CHAPTER XII

MANUFACTURES FROM FRUITS AND VEGETABLES.

By far the greatest industrial demand in the State of Washington seems to be for establishments that will preserve or more completely utilize the large quantities of fruit, berries and vegetables which grow in abundance in nearly all parts of the state. Altogether seventy-seven different communities have requested the location of canneries, seventeen others have expressed a desire for fruit by-product plants, seven for potato starch factories, five for beet sugar factories and three for pickle plants. The widespread nature of the demand is shown by the fact that thirty different counties of the total of thirty-nine are represented and that communities as far apart as the boundaries of the state will permit are included in the list.

EXPLANATION OF DEMAND.

Such a tremendous demand cannot be accounted for without some knowledge of the agricultural growth which has been taking place in the State of Washington during the past few years, and the possibilities for further development along such lines.

In the first place, every part of the state, with few exceptions, will under proper care yield fruits and vegetables in more or less liberal quantities. Certain sections, however, seem better adapted to some crops than to others; or the people for certain economical reasons have specialized in one branch of the industry, thus bringing it to a higher stage of development than would otherwise be possible.

FRUIT DISTRICTS.

The fruit producing districts of the state may be classified as irrigated and non-irrigated; but by far the most important commercially are the irrigated sections. Practically all of the irrigated lands lie in the valleys east of the Cascade Mountains, not more than about 6,000 acres, including the Sequim and

Yelm projects, being under ditches in Western Washington. A considerable amount of non-irrigated fruit, also, is raised in some sections of Eastern Washington and almost all the Western Washington fruit comes under this head.

YAKIMA VALLEY.

The most extensive fruit section is the Yakima Valley which contains three-fourths of the irrigated land of the state. This valley includes parts of Kittitas, Yakima and Benton counties and possesses the largest area of orchard lands now in bearing in Washington. It was one of the earliest sections to develop commercial orchards and is distinguished for the diversity as well as the quantity of its products. During the season of 1914 there were exported from these three counties alone, 3,333,877 boxes of apples, 484,024 boxes of pears, 1,117,245 boxes of peaches, 18,956 boxes of apricots, 68,670 boxes of cherries, 4,135,260 pounds of watermelons, 153,695 crates of cantaloups, 96,712 baskets of grapes, 25,513 crates of tomatoes and 44,836 crates of strawberries. In addition to these shipments, large quantities of these fruits were consumed locally in the homes or utilized in the by-product plants. The production for 1915 was somewhat less but in 1916 and 1917 a large increase occurred. Preliminary estimates for 1917 place the total apple production alone of this section at more than 10,000 cars.

WENATCHEE COUNTRY.

The Wenatchee Valley located in Chelan County is famous principally for the high quality of its big red apples, which are shipped to all parts of the United States and to many foreign lands. Pears, peaches, apricots, cherries and plums are raised in smaller quantities. In 1914 Chelan County alone shipped 5,302.6 cars of apples, 250.5 cars of pears, 272.6 cars of peaches and 357.3 cars of prunes, plums, apricots and cherries.

Tributary to the Wenatchee Valley are a number of smaller or less developed sections which include the Entiat Valley, the Lake Chelan region, the Methow and Okanogan valleys, some narrow strips along the Columbia River and parts of the Big Bend country. In 1915 the four counties of Chelan, Douglas,

No. 1. Picking strawberries. No. 2. Picking peaches. No. 3 Blackberries. No. 4. Grapes. There is great demand for can-
 neries to utilize these products which grow profusely in nearly all parts of the state.



Okanogan and Grant produced for commercial shipment 5,400 cars of apples, 350 cars of pears, 175 cars of peaches and 155 cars of apricots. In 1916 over 7,000 cars of apples alone were produced and about 700 cars of other fruit. In 1917 about 7,500 cars of apples and 600 cars of miscellaneous fruits were produced in this section.

SPOKANE AND SOUTHEAST WASHINGTON.

Spokane County ranks third among the fruit counties of the state. Tributary to it are the Colville and Pend Oreille valleys, the Palouse country, in certain parts of which a limited quantity of fruit is raised, and Northern Idaho.

Portions of the state south of the Snake River, particularly around Walla Walla and Clarkston, are also substantial producers of fruit.

WESTERN WASHINGTON.

In Western Washington, the principal commercial orchard crop is prunes, which are grown extensively in Clarke and Skamania counties; but the growing of pears is rapidly making headway, for experts agree that the soil and climate throughout this section are ideal for that crop. Berry growing has attained the greatest commercial success in the Puyallup Valley where special marketing facilities have been developed. Large shipments of the fresh berries are moved in refrigerator cars to eastern centers, while local canneries and processing plants conserve the residue. The Snohomish Valley and sections of King and Lewis counties also produce considerable quantities of small fruits and berries. Vashon Island and Kitsap County, besides producing much other fruit, are the principal strawberry sections of Western Washington, although this berry grows in almost any part of the state. Apples are produced in abundance, but commercial orchards are not extensive; about 800 cars were probably produced in 1917. Cherries are an ideal crop for Western Washington but large quantities are often left to spoil on the trees because of insufficient marketing facilities.

TOTAL FRUIT CROP.

While the fruit crop is naturally subject to fluctuation, the entire state markets yearly more than 15,000 carloads, valued

at from ten to twelve million dollars. Estimates for the year 1917 place the total production of apples alone in the state at nearly 20,000 cars, a larger quantity than that of any other state and more than the combined commercial production of New York and Missouri, formerly the leading apple states in the Union. Other fruits produced, not counting that used in by-product factories, were: Peaches, 2,112 cars; pears, 1,465 cars; and cherries, plums, apricots, strawberries and other small fruit, 1,000 cars.

The total commercial production of fresh fruits marketed during the season of 1915, the last year for which final figures are available, was as follows: Apples, 9,551 cars; pears, 1,416 cars; peaches, 2,092 cars; grapes, 56 cars; plums and prunes, 523 cars; apricots, 176 cars; cherries, 321 cars; watermelons, 164 cars; cantaloups, 336 cars; tomatoes, 90 cars; strawberries, 345 cars; other berries, 586 cars; mixed fruit, 758 cars. During the same time by-product plants used: Apples, 14,202,580 lbs.; pears, 2,161,862 lbs.; peaches, 585,702 lbs.; plums and prunes, 1,363,538 lbs.; apricots, 163,305 lbs.; cherries, 1,297,420 lbs.; grapes, 678,950 lbs.; raspberries, 4,946,144 lbs.; blackberries, 3,417,152 lbs.; strawberries, 1,466,674 lbs.; other berries, 979,517 lbs.

The tendency is for a very large increase in most of these fruits in the future as the younger orchards begin coming into bearing. Four years ago the total number of bearing trees of different kinds were estimated to be as follows: Apples, 5,608,593; pears, 397,320; peaches, 593,239; apricots, 69,166; plums and prunes, 821,078; cherries, 241,284. The fruit trees then five years old or younger totaled: Apples, 3,952,585; pears, 170,414; peaches, 52,718; apricots, 26,935; plums and prunes, 174,298; cherries, 59,059. During the seasons of 1914 and 1915 there were planted: Apples, 263,332; pears, 69,842; peaches, 18,787; plums and prunes, 76,305; apricots, 9,395; cherries, 68,846. While some trees have died and orchards been cut down since that time, the new plantings have more than offset the loss, so that the total number of trees in the state has undoubtedly increased rather than diminished.

VEGETABLE PRODUCTION.

Not so much data is available regarding the quantity of different vegetables produced in the state, as of fruits. The main crop for commercial purposes is potatoes, to which about 60,000 acres are devoted annually. The average yield per acre is from four to five tons, but the best lands go much higher, often as high as fifteen tons. Washington's annual contribution is nearly ten million bushels, or about 300,000 tons. Other vegetables besides potatoes grow well in all parts of Western Washington and in most sections of Eastern Washington, excepting in the very dry sections where water is not available. The market gardeners work the heavy soils closest to the larger cities.

Indicative of the soil fertility for vegetables, it has been estimated by authority that an average yield per acre, under good conditions, of valley land similar to that in the Puyallup Valley should be: of potatoes, 5 to 7 tons, depending upon variety; of onions, 8 to 12 tons; early cabbage, 10 to 12 tons; late cabbage, 20 to 30 tons; cauliflower, 9 to 15 tons; celery, 8 to 10 tons; string beans, 4 to 5 tons; green peas, 2 to 4 tons; table beets, 3 to 12 tons; rhubarb, about 10 tons; and squash, 20 to 25 tons. The best of the irrigated lands will yield equally well or better, as shown by the fact that the average yield of potatoes per acre on the Sunnyside project in 1915 was 217 bushels and the maximum 600 bushels. "Fruits and vegetables in abundance wherever you have a notion of planting them; there are thousands of dollars' worth of canned stuff shipped in every year; why not ship it out?" says one correspondent. This may be considered a representative statement regarding conditions in most other parts of the state.

Commercial shipments are made annually of potatoes, onions, egg plant, cabbage, cucumbers, rhubarb, carrots, asparagus, celery and smaller quantities of other miscellaneous vegetables, chiefly from the Yakima Valley, Spokane County and Southeast Washington. The extent to which production could be carried on is limited only by the market for the products, or the demand on the part of the canneries and by-product

plants. The variety is limited only by the possibilities of a temperate zone.

SURPLUS FROM SPECIALIZATION.

From the foregoing it can be readily understood that the State of Washington is well adapted to the raising of fruits and vegetables, and that some sections have already experienced considerable development along such lines, while others are rapidly advancing. It stands to reason that where specialization either in fruits or vegetables is emphasized, particularly where perishable crops are concerned, a heavy surplus must



A PRUNE ORCHARD.

Washington stands third in the union in total production of plums and prunes.

occasionally occur, which cannot be readily assimilated with the world's commerce. To lessen the chance for such a condition, various selling agencies or associations have been formed, aided by the United States Department of Commerce, which is represented in this state; also by the State Bureau of Markets created by the last state legislature.

In spite of such precautions, however, the chances for a certain amount of waste still exist. Where a stiff market prevails, as it has during the year 1917 (a most exceptional year), products considerably below the highest standard will readily

find purchasers; but if, on the other hand, a heavy yield in a particular crop has been realized in most sections of the world which produce it, products which are not strictly first class will suffer and the resulting profit to the producer may be so small that it may not pay to pack them at all. Under such circumstances canneries or by-product plants would save these lower grade materials and net the producer something for his surplus.

EVIDENCES OF WASTE.

But a large percentage of the waste which occurs, especially in the orchards, is not necessarily on account of too large a crop. There is bound to be more or less waste under any circumstances, since products which are undersized, injured in harvesting, slightly diseased, or blemished in any manner, cannot usually be put upon the market. For the year 1916 the Wenatchee district alone reports that more than a thousand carloads of apples were left in the orchards because of lack of market. In the same valley it is estimated that, in 1915, 800 carloads of wormy cull apples went to waste and that 116 cars of loose apples were shipped to by-product plants in other parts of the state.

Definite figures of unutilized material cannot be obtained, as there is no report made by the different orchardists and gardeners regarding such materials. It is evident, however, that thousands of tons of fruits, berries and vegetables are allowed to rot every year or be only partially utilized. Such waste is not confined to any one section but to all sections.

In a bulletin issued by the State College the following significant statement occurs:

“One of the most serious and pressing problems at present confronting the fruit growers of the state is the problem of making such disposition of their low-grade and surplus fruit as shall convert it into an assured source of revenue. The aggregate losses sustained through failure to make profitable disposition of low-grade and cull apples, surplus berries, cherries, peaches and other fruits which cannot be shipped to distant markets in the fresh conditions are already high, and will increase materially as the more recent plantings come into full bearing.”

"Much waste" is the main reason given by many of those asking for canning or by-products establishments in their communities. A correspondent from Kennewick says: "There are hundreds of acres of orchards in bearing and many acres of other products, some of which go to waste now, that could be harvested at the right time and made use of in such a plant; and the present acreage of many products can be trebled and more if a dependable market can be assured." Another from Peach, Lincoln County: "Considerable fruit grown along Columbia and Spokane rivers tributary to this point but so far from transportation that all but the best goes to waste." Sundale, Klickitat County: "There are about 400 acres of orchards here and this being about five miles from station it has been found that the fruits, mostly apricots, do not ship well after being handled that distance fresh." Toppenish, Yakima County: "Great quantities of fruit in territory tributary to Toppenish not utilized, particularly low-grade variety." Zillah, Yakima County: "Tons of peaches and pears go to waste every year." Colfax, Whitman County: "Yes, in this immediate vicinity a great quantity of apples, cherries, pears and berries go to waste every season. Green beans, peas, corn and other vegetables would be raised in large quantities if a market were provided." Byron, Yakima County: "This is an irrigated district. A great deal of fruit is grown and much goes to waste that is not suitable for shipping market in present form." Gifford, Stevens County: "Large quantities of fruit grown here which could be better handled in condensed form than otherwise. Much of the fruit is allowed to decay owing to the expense of shipping in its bulky form."

The percentage of fruit wasted is especially large in many sections of Western Washington, where tons of apples, pears, cherries and berries are grown, but where marketing facilities have not been sufficiently developed. The flavor of most fruit grown west of the mountains is exceptionally good; but the fact that some varieties are not so highly colored nor handled so carefully as in the famous orchards of Eastern Washington prevents its attaining the highest commercial value as fresh

LOCATIONS DEMANDING FACTORIES FOR CEREAL, FRUIT AND VEGETABLE PRODUCTS

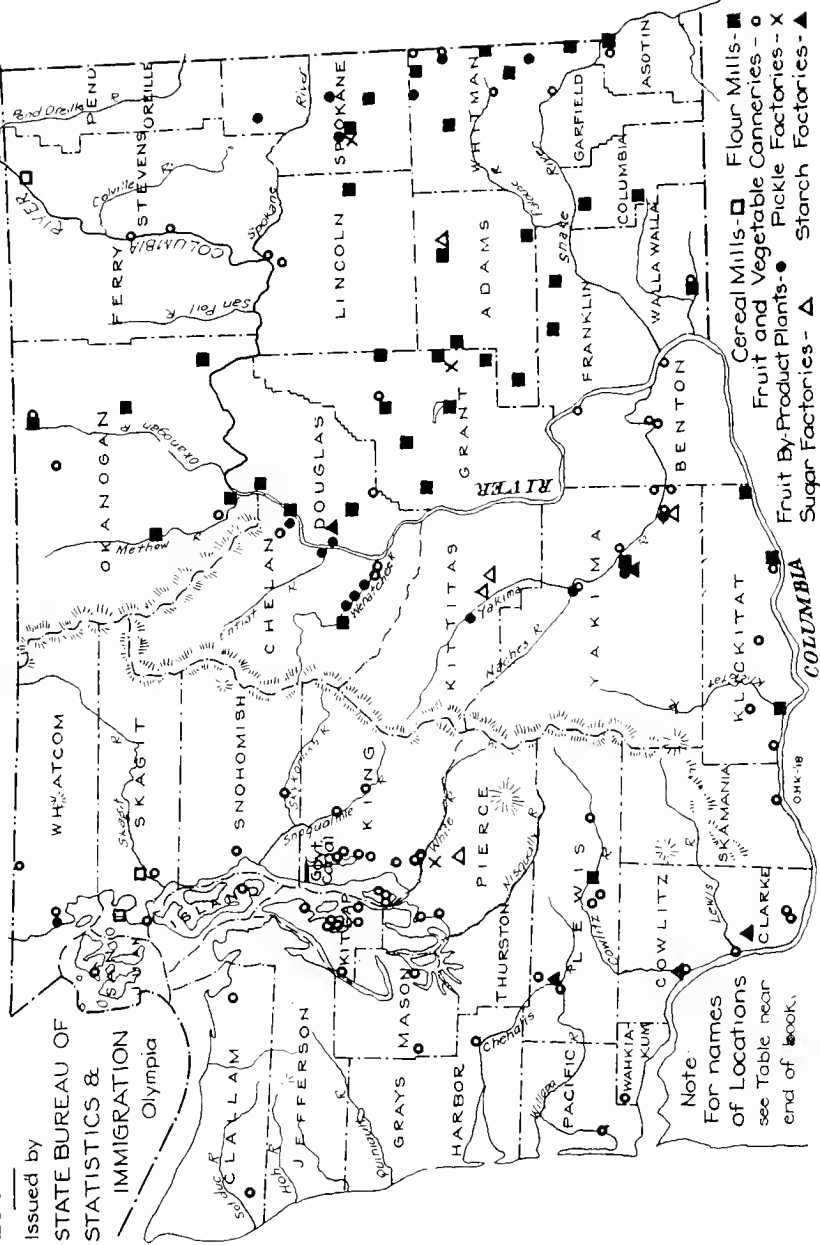
Issued by

STATE BUREAU OF

STATISTICS &

IMMIGRATION

Olympia



Note:
For names
of Locations
see Table near
end of book.

Cereal Mills - □ Flour Mills - ■
Fruit and Vegetable Canners - ○
Pickle Factories - ×
Starch Factories - △

fruit. For the preserving plants, though, such blemishes would not be considered objections.

A correspondent desiring a cannery at Deep River, Wahkiakum County, says: "There is a lot of fruit such as apples, pears and evergreen blackberries that goes to waste in this and neighboring communities each year on account of the poor market for same. This fruit could be bought cheap from the farmers and there is no question but that the enterprise would be profitable. There is considerable fruit raised in this locality and all of the fruit on the Oregon side of the river as far up as Rainier, Oregon, could be profitably bought and canned here. There are carloads of evergreen blackberries in the Nasal River district, 5 miles from Deep River, that rot every year because the expense of shipping them to the cannery at Chehalis eats up all of the profits of picking them."

A prominent citizen at South Bend, Pacific County, says: "Several carloads of evergreen blackberries and other fruits are going to waste each year; also quantities of vegetables. A large amount would be grown if there was a market." Mossy Rock, Lewis County: "It is a very good fruit growing country and lots of fruit is spoiled every year." Steilacoom, Pierce County: "A great deal of fruit and vegetables raised on the various islands and mainland which now go to waste could be used, and the amount now raised vastly increased, if there was any incentive." West Sound, San Juan County: "There is a lot of fruit goes to waste every year that could be bought cheap and canned." Lisabuela, King County: "Much fruit and berries are lost annually because of low prices." Medina, King County: "There are so many fruits and vegetables going to waste." South Colby, Kitsap County: "Every year hundreds of tons of fruit go to waste because we have no market; if we had a cannery the farmers would be encouraged to save their fruit as well as plant more vegetables." Centralia, Lewis County: "Large quantities of low-grade apples are going to waste in this community every year; also cucumbers and other pickles. Fruits do well here and cabbage does better in this vicinity than in any other region of the west. The apples and fruit are at hand and the rest of the materials can be produced

in a year." Montesano, Grays Harbor County: "Tons and tons of evergreen blackberries go to waste here."

PRESENT EFFORTS TO CONSERVE INSUFFICIENT.

Such are a few instances, chosen at random, of communities asking for fruit or vegetable preserving plants because of the almost universal waste tolerated in the year 1916 and previously. To be sure, the increased cost of many food necessities has resulted in greater efforts at conservation during the year 1917 and brought about the establishment of some additional plants and the organization of many home and school canning and preserving clubs; but such sporadic efforts will be far from sufficient to make use of all the surplus to be expected in the future or encourage further agricultural development.

CANNED FOOD A NECESSITY.

It should not be forgotten, also, that the world is gradually getting into the habit of using more and more canned goods, especially since modern science has more nearly solved the problem of perfect preservation. Canneries are not simply plants for saving waste products as formerly. They have become necessary establishments from every standpoint. If there were no surplus it would be necessary today to plant extensive areas in order that a supply might be available after the season had gone by, or for those sections of the world where similar products do not grow. In fact, every year in some sections many farms or gardens are planted with no other purpose than selling to the cannery and keeping it properly supplied with the crops necessary for its maintenance.

This takes the cannery out of the class of a "scavenger" as formerly considered and makes it one of the dignified establishments of the country. From this standpoint, it becomes one of the greatest agencies in building up a fertile country and, in turn, benefits from the good which it has accomplished.

There are many sections in Washington where production could be greatly enhanced if the growers could be sure of disposing of the crop at a price sufficient to justify the expense and effort. They would willingly make contracts with any reliable cannery to raise the material needed. There are districts

satisfactory for the enterprise where no development whatsoever has taken place, sections which might rival the Puyallup Valley in the yielding of by-products from fruits and vegetables. Such districts are both in Western Washington and in Eastern Washington, where new irrigation projects are being planned or old ones extended.

MORE PLANTS NEEDED.

From the foregoing facts recounted, it must be quite apparent to anyone interested that additional fruit and vegetable plants are needed:

First, to preserve the materials going to waste;

Second, to give more stability to the market for certain products;

Third, to encourage old sections to greater effort and open up new districts;

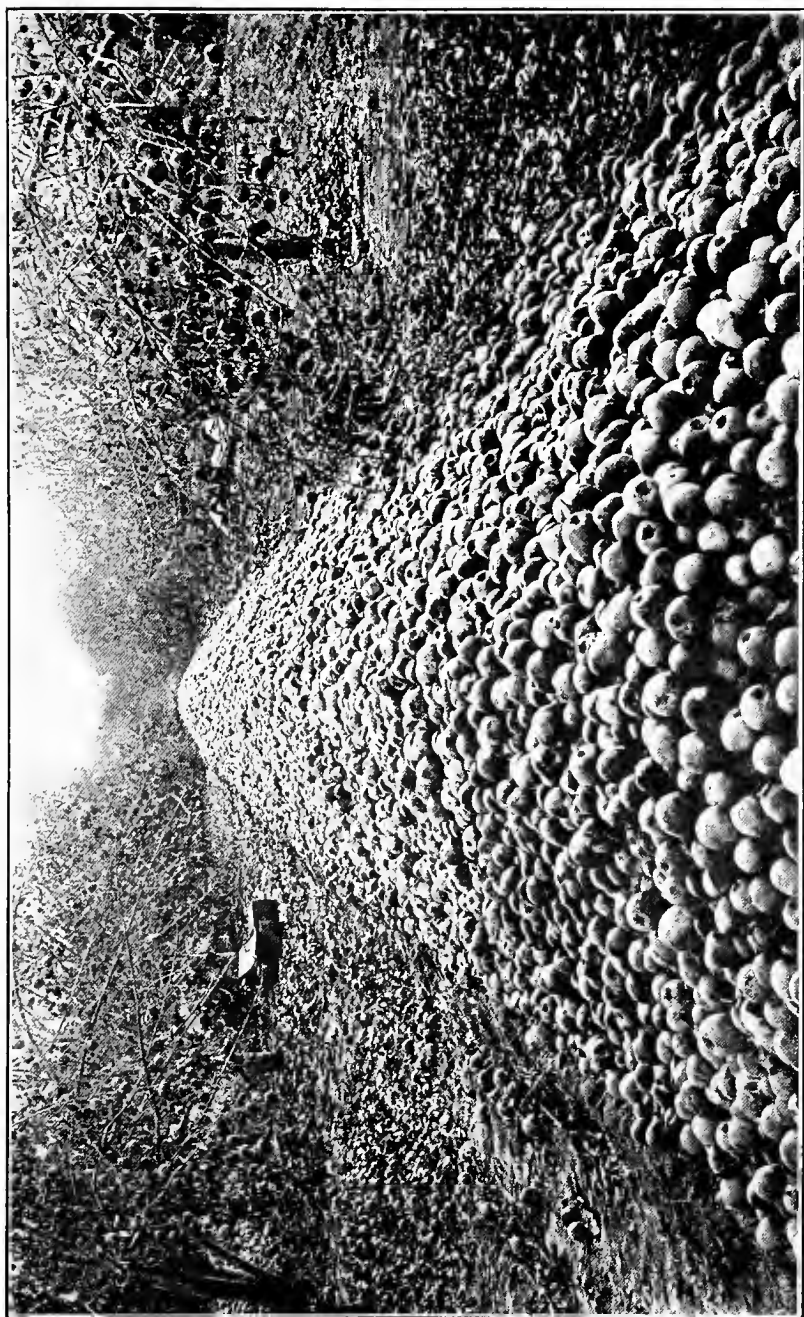
Fourth, to supply the producing localities as well as other parts of the world with canned fruit and vegetables, and to insure for them certain luxuries which depend upon such crops for their manufacture.

KIND OF PLANT.

Just what sort of plant is best suited to a community's needs should, perhaps, be left to the decision of those in a position to undertake the work. The economic changes which are rapidly taking place make it necessary to give special consideration in every instance. The 1914 census of manufactures showed the presence of 18 plants in the state engaged in the canning and preserving of fruits and vegetables, and 12 manufacturing pickle preserves and sauces. This, of course, did not include the individual dryers or evaporators, which are necessary parts of the equipment of the prune growers of Clarke County, where most of the plums and prunes of the state are produced; 256 dryers are reported for that county alone.

COMBINED CANNERIES IN DEMAND.

The main cry is for combined canneries, as they stand a better chance of being supplied with material most of the year, without the need of increasing either the equipment or the number of the operators. As an example, one cannery reports that



Fifty-five carloads of apples were gathered from a forty-acre orchard.

in 1916 it canned: Apples, 1,045 tons; pears, 186 tons; peaches, 1 ton; cherries, 111 tons; strawberries, 221 tons; blackberries, 1,024 tons; raspberries, 1,485 tons; other berries, 375 tons; beans, 6 tons; cabbage, 675 tons; squash, 67 tons; cucumber pickles, 600 tons; grape juice, 15 tons. Additional items reported by other factories, illustrating the variety of products, are apricots, quinces, plums and prunes, crabapples, gooseberries, cranberries, currants, tomatoes, cauliflower and spinach.

Some of the larger plants combine with their cannery department an evaporating plant where portions of the fruit not so well adapted for canning can be dried. The more complete factories also utilize the peelings and pulp of some of the fruits in making vinegar, which is either sold or used in their own pickling departments.

Since the state is now in the prohibition column, various juices have become very popular, including loganberry juice, apple juice, cider and grape juice. Jellies, jams, apple butter, syrups, vinegar, etc., are almost household necessities.

Beet sugar plants, which are just beginning to be established, and starch from potatoes, which has thus far received no industrial attention, have been noted in the chapter entitled "Miscellaneous Manufacturing Possibilities."

EVAPORATORS AND CANNERIES COMPARED.

Bearing on the decision as to the class of plant to be chosen, the following salient points taken from a late State College bulletin are of marked importance:

"Since there are, broadly speaking, two general methods of preserving perishable foodstuffs, by sterilizing with heat and sealing, or by reducing the moisture content to a point at which growth of bacteria and fungi cannot occur, the by-products plant must be either a cannery or an evaporator. If it is to utilize fully all the unmarketable and surplus fruits of its district, the cannery must carry on such related activities as the making of jams, jellies, marmalades, preserves, fruit butters, and cider or vinegar; while the evaporating plant may advantageously utilize its waste by manufacturing vinegar therefrom. Consequently, any step toward utilization of low-grade fruit in a community involves first of all a decision as to whether a

cannery or an evaporator will best meet the needs of the particular case. A very large number of factors, some of which are obvious while others are apt to be overlooked by persons unfamiliar with the operation of such plants, need to be very carefully considered in making such a decision.

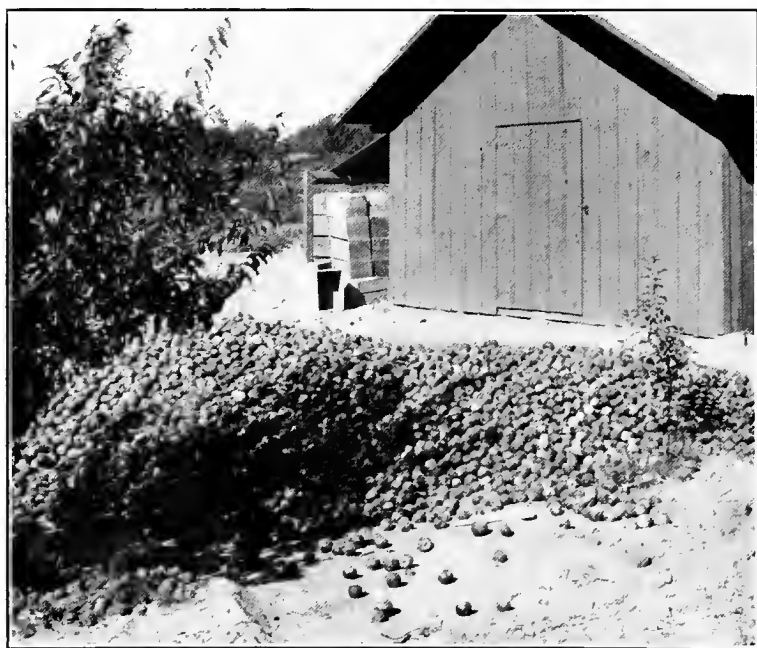
"Briefly stated, success in the establishment and operation of a cannery demands ample capital for installing efficient modern equipment and employing well trained and experienced supervisors of the technical processes involved, as well as for the purchase of cans, raw materials and labor, and for carrying the manufactured product in storage until favorable marketing conditions are obtained. There must be available at moderate prices an ample supply not only of fruits but of vegetables also, in order that overhead charges may be reduced by a long working season at full capacity. Transportation facilities must be good and rates must be favorable, since the plant will purchase its cans and its fuel at a distance and will have to transport its bulky product to the markets. Fuel and labor must be obtained at moderate rates. Finally, every cannery has to solve a marketing problem distinct from that of every other similar concern.

"Comparatively speaking, the evaporating plant has many advantages over the cannery. The initial cost of building and equipment necessary to handle a given volume of material is much less; the machinery is less costly and depreciates much less rapidly. The employment of a technically trained, high-salaried supervisor is not necessary. Therefore, the fixed charges (interest on investment, depreciation, insurance, supervision) are proportionately lower and many of the best evaporators of the eastern apple districts make a profit despite the fact that they dry nothing but apples, hence operate only about sixty days each year. Under the conditions prevailing in Washington this would scarcely be possible, but there are few districts in the state in which an evaporator would not have either peaches, berries or prunes in some quantity, to lengthen its operating season. While the evaporator is by no means independent of facilities for transportation, it has the enormous advantage that it produces a concentrated product which can be transported far more cheaply than either fresh fruit or canned goods; which requires no outlay for expensive containers, and which can be stored almost indefinitely, under proper conditions, in relatively small space. Finally, the product is one which is readily examined and graded, hence every lot goes on the market at the price to which its quality entitles

it, and does not depend upon brand name or previously established reputation for its sale."

CONDITIONS FAVORABLE.

Whatever the requirements of any particular cannery or evaporator might be, however, it is quite certain that the State of Washington offers as favorable conditions as can be expected anywhere for its installation and successful management. The raw materials for every kind of establishment needing fruits or vegetables of any variety are either already here or the chances are good for their production. A careful investigation of the conditions and opportunities in Washington is recommended on the part of those given to the work of preserving food materials from useless decay or perfecting their utilization.



APPLES CULLED AT PACKING HOUSE.

Thousands of tons of fruit are annually lost for lack of factories to conserve the waste.

CHAPTER XIII.

MANUFACTURES FROM CEREALS.

BY GEO. A. OLSON,
Chemist, Washington Experiment Station,
and State Chemist.

Wheat is the principal cereal grown in the State of Washington. Its average yield is approximately 40,000,000 bushels, a quantity which places this state seventh in the Union from the standpoint of wheat production. Oats, next in importance, amount in quantity to about one-third of the wheat produced in the state. Barley production comes next, reaching about 6,000,000 bushels per annum. Practically all the commercial wheat and barley and a large share of the oats of the state is produced in Eastern Washington. Soft wheat, suitable for feed is grown in Western Washington and some of the valleys of this section have phenomenal yields of oats. The quantity of rye, corn, buckwheat, flax, etc., is comparatively small.

WHEAT.

In the earlier period of agricultural development most of the wheat raised in the state was exported to foreign countries. At the present writing approximately one-half of the total production is reduced into flour in mills located in various parts of this state; the remainder is shipped out of the state either to various points in the United States or to some foreign country. Thus it will be seen that we are passing from a condition where little wheat was milled into flour to one where the manufacture of flour is a large and important industry. A similar future development means that more food products will be manufactured within the state.

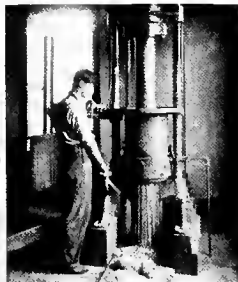
Generally speaking, the wheats produced in the state are known as soft wheats, but some of the well known harder varieties are also produced here. The larger part of the hard wheat entering our mills, however, comes from states east of us. The flour made from the soft wheat is exceedingly white, while that made from the harder varieties is comparatively dark. Flour made from a mixture of the soft and hard type wheats improves the strength of the former and gives a better color to the latter.

These blended flours are considered as general all round ones, particularly suited to the various needs of the household. Besides the blended flours there are soft wheat flours made from one or more of the various varieties of soft wheat, and hard wheat flours made from hard wheat. The object of mixing or blending is to make a more uniform quality of flour than would be possible otherwise.

The hard wheat flours are the bread flours much sought for by the bakers. Owing to the limited amount of hard wheat produced in the state, it follows that either the mills or the bakeries must purchase their wheat or flour from points outside of the state. It is needless to say that a good grade of hard wheat can be produced in the state and there is a possibility that a great deal will be produced, providing the incentive to raise such wheats is present. Comparatively, the yields obtained by producing the soft varieties are much higher than those obtained from the hard varieties. The higher price for the lower yielding hard wheat is not sufficient to make up for the higher yield of soft wheat sold at a lower figure. This is unquestionably the main reason why the farmers are inclined to grow the soft wheat.

The quality of the flour made from soft wheat is good and with new methods of treating the wheat together with the added machine improvements the flour made is steadily improving. This transformation of quality has resulted from what appears to be forced competition, inasmuch as very little wheat is now being exported to South America and Asia.

While it has been recognized that the hard wheats are particularly suited to the bakers' needs, it should not be overlooked that the soft wheats can be equally as well utilized by them in a somewhat different method of handling the dough during the process of fermentation. What is needed in conjunction with the milling industry is the active co-operation of persons capable of showing the trade and the commonwealth in general the value of our home-made products, especially persons who know how to make bread from the flour milled from our home-grown wheats. Such a campaign has been made in some of our



WHEAT FROM FIELD TO FACTORY.

No. 1. Sacked for shipment. No. 2. Making macaroni. No. 3. Type of local mill. No. 4. The heavy yield for which Eastern Washington is famous.

eastern states and a similar one should be conducted in this state.

The unmixed soft wheat flours are used for other purposes besides making bread. Large quantities are shipped to various places in the east to be used as pancake, pastry, biscuit, or cracker flour.

The pancake flour is mixed with the necessary chemicals to make self-rising flours and these are sold in the southeastern part of the United States. The self-rising flour should be prepared at home and thereby avoid the extra cost involved in re-handling the flour.

The soft wheat flour, low in gluten, has been found to be exceptionally suited for pastry purposes. Such flour requires less shortening than that made from wheat carrying a large quantity of gluten.

Pie manufacturers of the east who have tried our pastry flour find it economical to use and that it pays to buy it because the saving in shortening more than offsets the high freight rates charged.

Flours carrying a semi-strong gluten content are particularly suited for the making of soda crackers. The manufacture of soda crackers is an industry in itself, and gives promise of developing to larger proportions owing to the fact that we produce the flour from which the best quality crackers can be made. As a state industry this should be enlarged upon and the sale of the product extended to the eastern markets.

Flours rich in gluten, such as those milled from durum wheats, to which some portions of Washington are well adapted, are best suited for the manufacture of macaroni and other forms of "Italian paste." This industry has already been established in several locations in the state and is capable of much greater development.

The remainder of the wheat produced in this state is disposed of in various ways. Some of it is milled into flour, some is made into breakfast foods and some is used as stock food. From the soft wheats used separately or in combination with other cereals excellent breakfast foods can be made. Manufacturers who make products like wheat flakes, shredded wheat bis-

cuit, cream of wheat, etc., will find our wheats suited to their needs. This phase of industrial development is worthy of consideration, inasmuch as the farmers of this state will produce wheat for many years to come. The manufacturing of the modified or finished product in the west has another advantage, namely, only one transportation charge instead of two as prevails at present.

STARCH, GLUCOSE AND GLUTEN.

Another possibility, so far as industrial development is concerned, has reference to the utilizing of wheat which, considered undesirable for milling, or for breakfast foods, might be manufactured into starch, glucose and gluten. The quality of starch and glucose made from wheat is as good as that made from corn, or other starch-carrying cereal. In fact the writer is of the opinion that a better grade of starch and glucose can be made from the wheat grain than it is possible to make from corn. While the use of wheat for making starch and glucose is not new, the separation of the gluten and its preparation into a useful food product according to the writer's method* is new. Instead of making glue, or feed for stock, the writer proposes that the gluten should be handled in the manner which he has perfected, namely, by retaining all of the original properties which gluten possesses; thereby preparing a material that can be used as an additional component for re-enforcing weak flours when strength is desired, or in combination with other materials as high protein foods, or as a food for flatulent or diabetic individuals.

In connection with this industry other products are made, such as stock food, etc. The manufacturing of starch, therefore, can be made a big industry and from a commercial viewpoint it is a very desirable one to follow. It should certainly be financed and developed.

*The process of preparing the gluten so that it retains its original properties is an invention of the writer. A patent has been requested and given to the people of the United States of America. This procedure will give anyone who sees fit to use the process, the right to make gluten according to the writer's method without paying any royalties. The process will be described in one of the Experiment Station bulletins issued at Pullman, Washington.

OATS.

While the amount of oats produced in this state is comparatively small (13,000,000 bushels), their quality is good. The berries are plump and contain considerable meat. The better grades are selected for making breakfast foods and the less meaty types are generally utilized in various ways as stock food. Owing to the excellent quality, more oats should be produced. They are well adapted to a system of rotation and the farmers should endeavor to grow this cereal in rotation with



A flour mill at Walla Walla. This county produces 5,000,000 bushels of wheat annually.

other crops. The breakfast varieties should be grown only on land that is free from wild oats, since the hulls of the latter are difficult to remove and when present the value of the breakfast food is lowered. A campaign to utilize the home grown oats and home-made cereal as a breakfast food will do much toward encouraging the farmers to grow not only more oats but better oats.

BARLEY.

The cereal which ranks next in point of production is barley (6,000,000 bushels). The larger part of the barley grown in this state has been used in stock feeding. Some of the varieties

have been used in making barley malt. The brewing industry, however, cannot now be considered important and as a result more barley will be available for other purposes. On the other hand, a limited amount of barley malt has been used in making malt extract and also in making non-alcoholic drinks. The malt extract is a valuable food for yeast and, as such, bakers make use of it in connection with dough fermentations.

In addition to the above named products made from barley, may be mentioned the manufacture of pearl barley and barley flour. Both of these last mentioned substances are important sources of food, and through organized effort it is possible to encourage their more general use. First class pearl barley is uniform in color and size. Certain varieties are more suitable for the making of pearl barley than others, and those who contemplate raising barley that will meet the above requirements should endeavor to keep the strains pure at all times; otherwise grains of varying color will surely follow. As much as 50 per cent. of barley flour has been mixed with wheat flour in bread making with good results.

CORN, RYE, BUCKWHEAT AND FLAX.

The cereals, corn, rye, buckwheat and flax are not extensively grown in this state. Corn is grown chiefly in the irrigated districts where the climatic conditions are suitable for its complete development. It is also grown in scattered places over the eastern part of the state and especially in selected places where the dangers of frost are slight. The annual yield is about 1,500,000 bushels. In the East, corn has been made use of industrially in various ways, among which may be mentioned the manufacture of starch, glucose or corn syrup, corn oil, hominy, grits, flour, meal and flakes. Most of the corn grown in this state is used as stock food.

About 100,000 bushels of rye is raised annually in Washington, but the flour made from it is comparatively weak and light in color. The eastern rye flour is stronger and darker in color and seems to appeal to the public more than the lighter product.

Very little buckwheat is grown in this state. The census figures give a yield of approximately 3,000 bushels.

Flax has never been grown in large quantities. If the growing of this commodity should ever become extensive it would find an ever increasing demand. Our present linseed oil supply is inadequate to meet the demand and much of that now offered for sale is mixed either with some other vegetable oil, such as soy bean oil, or with fish oil with or without crude oil products. The linseed cake derived by expressing the oil from the seed is also valuable as a food for stock and, owing to its laxative qualities, is almost indispensable in connection with other stock foods.

BEST OPPORTUNITIES FOR WHEAT PRODUCTS.

Summarizing this article on "Manufacturing as Related to Cereal Production," it is the writer's opinion that the best industrial development will be found in connection with the various ways of handling our surplus wheat. The flour products of known merit should be produced in larger quantities and new buyers sought. The varieties of breakfast foods that can be made from wheat alone or in combination with other cereals are numerous enough to justify manufacturers of this line of goods in establishing plants at the various centers where the varieties suitable for their needs are to be found. The manufacturing of starch, glucose, gluten and other products from wheat, appeals to the writer as one of the most promising industries that can be developed. For the present, these products are obtained exclusively from central western states and are derived from a cereal that has objectionable qualities. The gluten prepared by the patented method should be considered the product, and the starch and glucose the by-product.

To a less extent oats and barley have an important relation to the industries. A propaganda on their use in the diet will do much towards encouraging the farmers to produce more and better oats and barley, and at the same time be of material assistance in creating a demand for the manufactured products.

CHAPTER XIV.

DAIRY AND OTHER LIVESTOCK PRODUCTS.

Other fields for manufacturing endeavor lie within the realm of the dairy and livestock industries of the state. Opportunities along these lines should be comparatively numerous, as all classes of domestic animals thrive on the farms and ranges of Washington and a plentiful supply of milk can be relied on the year round. Dairying especially has experienced a phenomenal growth in Washington and today must be reckoned among the leading activities of the state. Butter, cheese and condensed milk manufactures amount to many millions of dollars every year. The State Commissioner of Agriculture in his most recent report says:

"Scarcely more than ten years ago, importations of butter from Oregon, California and the eastern states into the State of Washington were estimated in terms of millions of pounds annually. At the present time, the dairymen of this state are capable not only of supplying the home demand, but are likewise reaching out for outside trade.

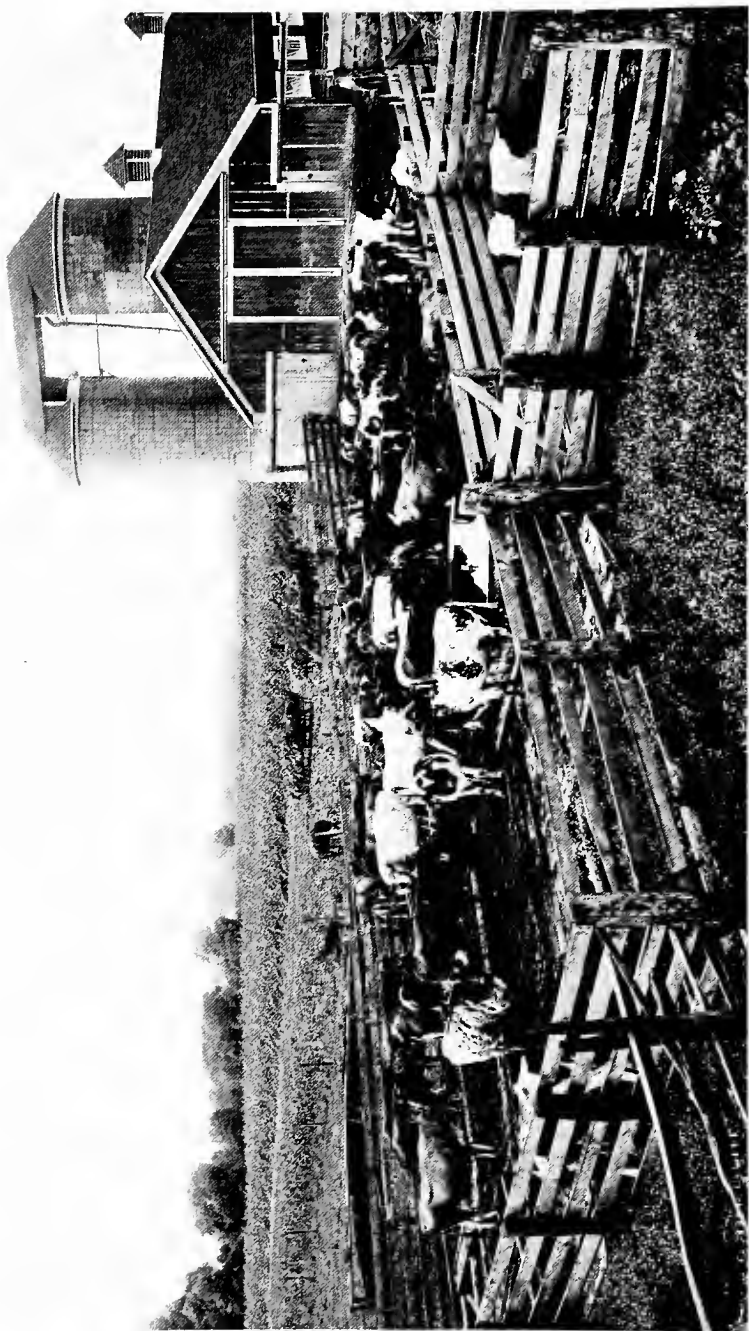
"When it is considered that the population of the state has increased by fully fifty per cent. during the past ten years, it will at once be apparent that some tremendous forces have been at work in connection with the development of the dairy industry. The three principal factors which have entered into and influenced the remarkable change which has been accomplished in so short a period may be enumerated as follows:

"(1) The soils of the state have been found wonderfully well adapted to pasture purposes and to the production of maximum yields of forage crops.

"(2) Climatic conditions, which lend themselves in every respect to successful dairying.

"(3) The extraordinary growth of the commercial and industrial centers of the state, which have supplied a market ready and alert to absorb the continually increasing output of the Washington dairy farms.

"Dairying is no longer a haphazard industry. It is a highly organized business of its own and when conducted upon scientific principles and under favorable conditions, which are presented in



A Washington dairy farm. Additional condenseries, cheese factories and creameries will encourage the establishment of more like this.

this state, offers a field of industry uniformly satisfactory and profitable."

FACTORIES HAVE SPRUNG UP.

As a direct result of these conditions, there have been established in various parts of the state, numerous factories which conserve the dairy product and convert it into butter, cheese or evaporated milk. At the present time, there are 150 creameries, 21 cheese factories and 12 condenseries. For the year ending June 30, 1916, the total production of milk and cream for the state amounted to \$7,100,047.93, representing 12,043,989 gallons of milk and 3,124,019 gallons of cream. During this same period the creameries used 14,931,285 pounds of butter fat, producing 18,333,474 pounds of butter, valued at \$5,500,540, of which there was exported 1,374,880 pounds. Cheese factories made 1,346,033 pounds of cheese valued at \$198,031 and the condenseries used 178,162,876 pounds of whole milk, producing 1,896,829 cases of condensed milk valued at \$6,252,893, of which 1,444,404 cases were exported.

NEW ESTABLISHMENTS NEEDED.

In spite of such advancement, there is still a demand for more establishments to conserve the present products or to encourage dairying where its possibilities are far in advance of the present development. There is also considerable butter and cheese still shipped into the state from other sections. It is probable that about 75 per cent. of the cheese marketed in Washington is shipped from outside.

In response to the recent questionnaire of this department, thirty-eight communities of the state report openings for creameries, fifteen for cheese factories and fifteen for condenseries. In some of these communities, the present milk supply is being shipped to other points and handled by existing establishments; in others, there exists practically no market during normal times for their milk. Most of them represent that the presence of a local plant would greatly stimulate the dairy business in their localities and lead to the increase of milk production.

At any rate, it is certain that the greatest need of this state in connection with the dairy industry is the development of new dairy districts. In many instances, this may be accomplished by the establishment of factories to stimulate intensive milk production. Wherever condenseries or large creameries have already been located most beneficial results have been realized. Yet there are numerous other localities, still practically untouched, that hold the potentialities of the Mount Vernon, Kent or Chehalis districts. Along with such factories are needed men or companies with sufficient capital and patience to take the necessary time to educate the farmers as to the best kind and quality of cattle, proper methods of feeding, handling milk, etc. The history of many dairy centers proves that such efforts pay and that remarkable industrial changes can be brought about by those who act as leaders in the matter of building up the farming communities surrounding their plants.

OTHER LIVESTOCK.

Manufacturing depending on cattle and other livestock should be such as to encourage greater effort in their production. The demand for beef and other meats is increasing, as is well known, and to supply it is becoming more difficult. There are already several meat packing plants in the state and these are compelled to import large quantities of their stock from other states.

Nevertheless, Washington is holding its own in the matter of raising livestock of all kinds excepting hogs, as a comparison of the records for the past few years will show. Every March the county assessors take a census of all domestic animals kept. According to the 1917 report there was a total of 1,340,843 head of livestock in the state valued at fifty-four million dollars (or eight million more than in 1916), a falling off of 44,000 head during the year and accounted for chiefly by the smaller number of hogs produced. This is an increase, however, of 333,000 more than in 1911 and compares favorably with the estimated increase in population.

TABLE SHOWING NUMBER OF LIVESTOCK IN WASHINGTON DURING YEARS 1911, 1916 AND 1917.

(From Report of State Board of Equalization.)

	1911	1916	1917
Horses	264,638	270,964	272,280
Milch Cows	136,934	191,822	190,361
Other Cattle	125,064	262,798	272,399
Sheep—Goats	388,205	502,152	489,750
Hogs	93,000	156,338	116,033
Totals.....	1,007,841	1,384,074	1,340,843

WOOL PRODUCTION IMPORTANT.

A half million sheep would naturally place wool among the important livestock products. This, with mohair, is a raw material which offers great industrial possibilities for the Northwest. The fleece of the Washington sheep is heavier than in any other state, averaging during the years 1914, 1915 and 1916, 8, 8.7 and 8.6 pounds respectively. Goat fleeces weigh from 3 to 4 pounds. The total wool product during the corresponding years was 3,638,000 pounds from 455,000 fleeces; 4,560,000 pounds from 525,000 fleeces and 4,750,000 pounds from 555,000 fleeces.

At the present time eastern Washington produces most of the sheep, and what few goats are raised are chiefly on the logged-off lands of western Washington.

The wool production has created demands for several wool scouring plants and woolen mills, in both eastern and western Washington. These merit careful consideration as indicating sites for woolen yarn and textile mills.

LEATHER GOODS.

Among other by-products of the livestock industry are many hides, but few local tanneries or leather working factories exist, while the demand for leather and leather goods far exceeds the supply. With the great quantity of tan bark grown in this state (see pages 87 and 167), and the liberal hide supply, it seems that a very good opportunity exists for the development of this industry.

CREAMERIES, CONDENSERIES, AND CHEESE FACTORIES IN OPERATION

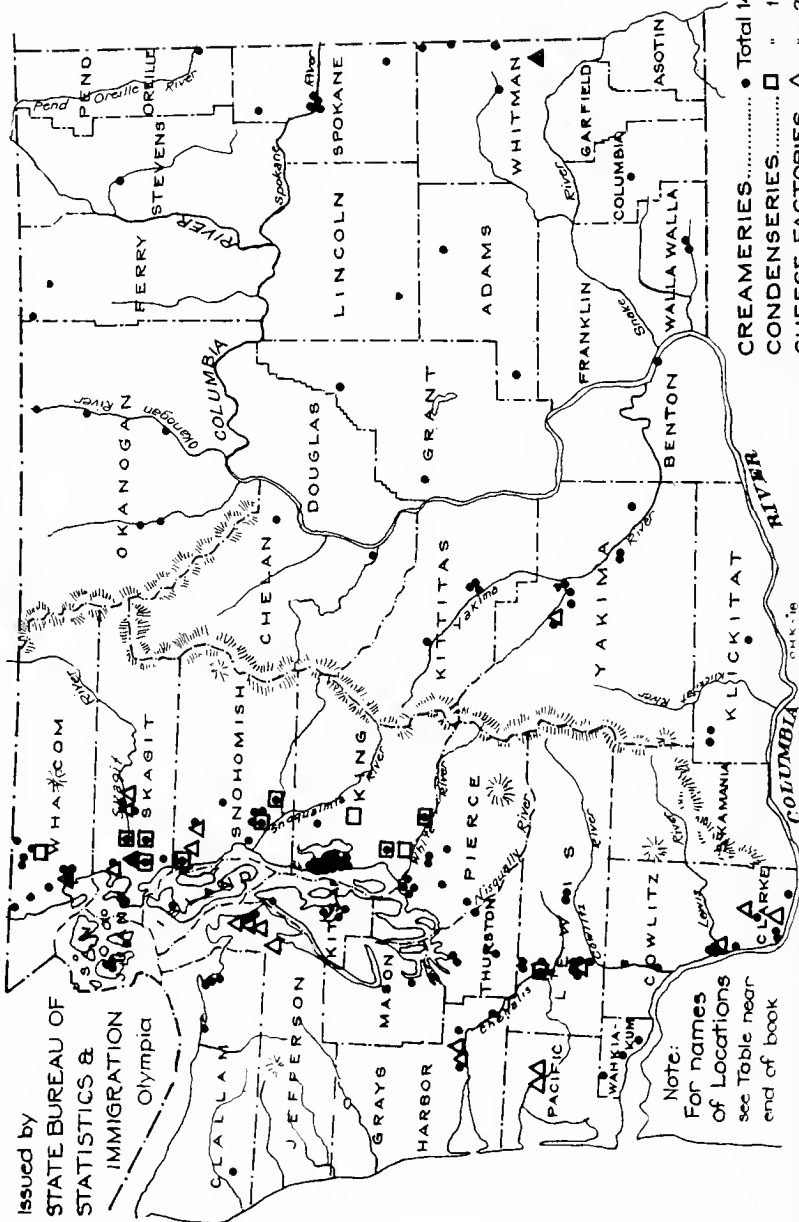
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LOCATIONS WHERE DAIRY PRODUCTS FACTORIES ARE REQUESTED

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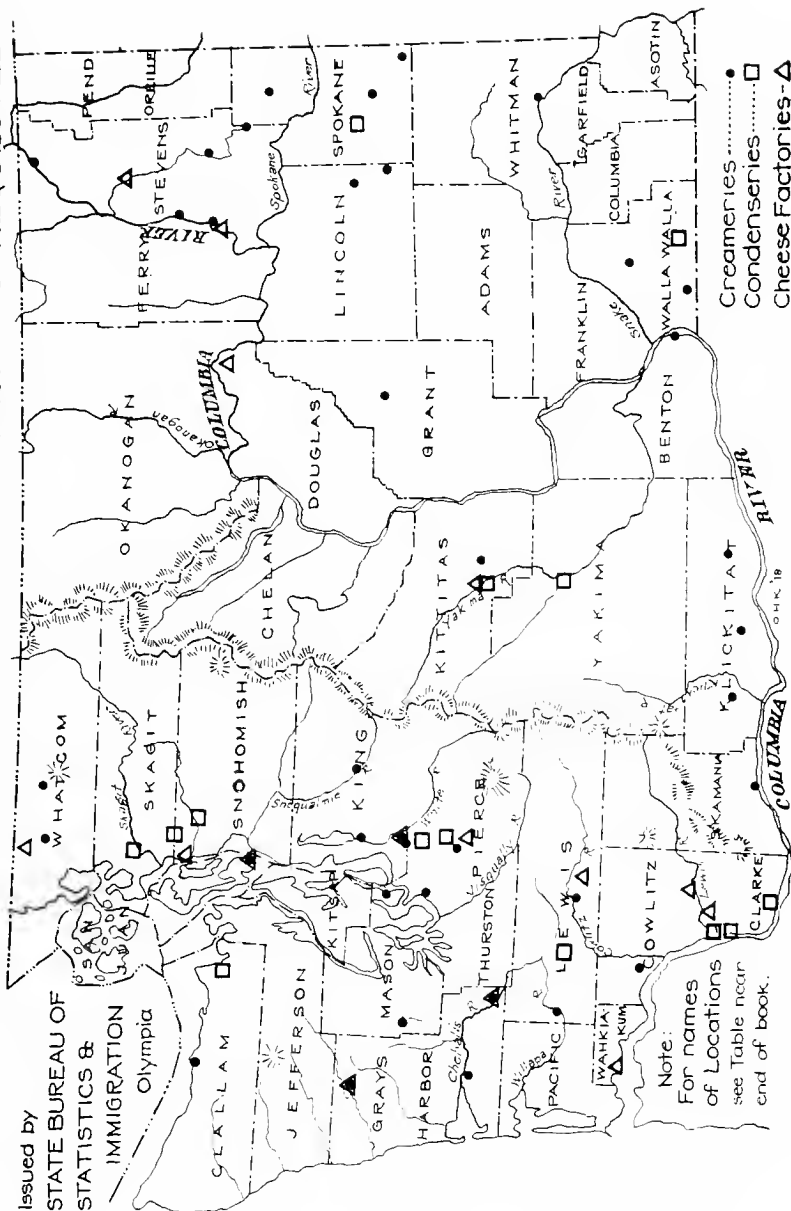
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Note:

For names of Locations see Table near end of book.

Creameries.....●
Condenseries.....□
Cheese Factories-Δ



CHAPTER XV.

POSSIBILITIES FOR TEXTILE MANUFACTURING IN WASHINGTON.

BY GRACE G. DENNY,

Assistant Professor of Home Economics, University
of Washington.

Besides the advantages which Washington offers for manufacturing in general, there are certain ones that are peculiarly adapted to the textile industries. For one thing, a moist atmosphere is necessary for the satisfactory spinning of all fibers. When moisture is not present in the air it must be supplied artificially. Such condition is well satisfied in this state for the climatic conditions of some parts of Washington are almost identical with those of the great textile manufacturing districts of England and Ireland.

Then, an abundance of pure water, free from mineral constituents, is necessary for the satisfactory scouring and dyeing of wools. Chemically softened water is employed in some mills in other states, but in Washington, where an almost unlimited supply of pure mountain water is available, this is unnecessary. The composition of the water is also of first importance in the retting of flax as will be explained later.

The most difficult question in a new industrial community is the one of supplying skilled labor. In the middle west and west this problem has been solved by taking young people in the local community from other occupations and re-educating them. In Washington the difficulty might best be overcome by establishing in the schools vocational courses that would prepare for skilled operative work in textile mills as the demand for them becomes apparent.

Another important advantage enjoyed by the West is the condition of the factory worker. He is usually healthier, more self-reliant, and more intelligent than such employes in large industrial districts in the east. The mild climate makes out-of-door living possible. The free and independent spirit of the country encourages self-reliance. There is no loss of efficiency because of violent extremes of heat and cold. Easterners com-

ing to the Coast find their working capacity greatly increased in an atmosphere that conserves their nerve force. The 8-hour law for women and the minimum wage law (\$8.90 per week for manufacturing) also tend to create a higher standard of living.

COTTON AND SILK MANUFACTURING.

The manufacture of cloth from cotton and silk has not yet been established upon the Pacific Coast, but the favorable climatic conditions, the abundance of cheap power, and the fact that cotton could be transported here at a low cost via the Panama canal and that much of the raw silk from the Orient passes through Puget Sound ports on its way to eastern manufacturing centers, suggest that these branches of the textile industry may be profitably developed in the future.

WOOLEN MANUFACTURING A BASIC INDUSTRY IN WASHINGTON.

The possibilities for woolen manufacturing are much greater, for the making of woolen goods is a basic industry in Washington, just as lumber and fish canning are basic industries. According to the Department of Agriculture Yearbook 1916, 555,000 fleeces are credited to Washington which amounted to 4,750,000 pounds of wool in the grease.

The following figures show the production of wool in the three neighboring states. Montana is a close second to Wyoming, the largest wool producing state in the Union:

	Number of Fleeces 1916	Average Weight per Fleece in Pounds	Raw Wool Product in Pounds
Montana	3,150,000	7.8	24,570,000
Idaho	1,980,000	7.6	15,000,000
Oregon	1,760,000	7.5	13,200,000
Washington	555,000	8.6	4,750,000

While Washington does not rank first in the production of raw wool, she may draw from these large wool producing states where, aside from the mills in Oregon, there is practically no manufacturing done.

Wools produced in the United States are not as fine as imported wools, because sheep growing in this country has been directed largely toward the production of mutton, in which there is more profit and less work than in the wool itself. Lincolns and Cotswolds have been bred rather than Merinos, because the last (the best wool bearing animals) do not produce the best or the most mutton. Growers find it more profitable to shear the lambs and then dispose of them for meat and hides than to keep them for shearing purposes. Much of the wool is pulled, *i. e.*, chemically loosened from the pelts of the slaughtered animals.

For high grade cloth this native wool must be blended with finer wools. For heavy fulled goods such as mackinaw cloth the domestic wool is suitable. The need for soft water in the scouring and dyeing processes has been pointed out.

Besides raw material there must be an immediate market for a large part of the product. What sort of market for woolen goods do we find in the Pacific Northwest? The chief demand is for a heavy, coarse grade material such as mackinaw cloth and other coatings and heavy warm blankets for loggers and miners. This is true of Alaska as well as of the Northwest states. It is obvious, then, that the first needs will not be for fine and delicate fabrics. The making of coarse cloth requires less skill and entails no losses from fashion changes. It is this class of goods that the small mills already operating in Washington and Oregon are producing.

The most crying need at present is for more wool. The increased need for wool for our army and navy and for the allies make it imperative that we raise more raw wool. A sheep growing propaganda has been launched by a number of agencies with the hope that their slogan, "more sheep, more wool" may be realized. An increased production of Angora goats has also been advocated. The meat may be used as mutton and the skin is more valuable as leather than that of the sheep. The fiber is long, lustrous and strong. A very fine grade of mohair has been obtained from Angora goats in the Pacific Northwest.

A leading textile journal has advocated the production of wool under contract to the manufacturer, just as the canners of



SHEEP GRAZING ALONG THE SNAKE RIVER.

Wool growing is a leading industry of eastern Washington, providing abundant material for textile mills.

fruits and vegetables now arrange to take over the entire crop of a certain number of growers. If, as in England, the small farmers should each keep ten or a dozen sheep, and sell the wool, the situation might be improved.

A phase of the wool industry which has been scorned and misunderstood, is the re-manufacture of wool, *i. e.*, the separation of the fibers from cloth, either old or new, and scouring, respinning and weaving it into cloth again. The use of the term "shoddy" has been unfortunate in this connection. Because of the shortage of wool, occasioned by the war, the government has been obliged to introduced re-worked or "reclaimed" wool into blankets and soldiers' clothing. Since the government has given approval to the conservation of rags and the utilization of shoddy, it may now be possible to popularize these products.

It is certainly a patriotic measure, especially today, to supply the country with warm clothing. While it might be untimely to propose the erection of woolen mills on a large scale in Washington, the history of successful business enterprises shows that, with small beginnings and a patient willingness to expand as the market grows, an industry of this kind may be soundly established.

A number of small woolen mills located in western Washington, if operated wisely should develop into good paying investments.

LINEN MANUFACTURING UNDEVELOPED IN AMERICA.

The making of linen cloth is one branch of textile manufacturing which has not been developed to any extent in America. We have produced flax, but principally for the seed.

In 1915 the Department of Agriculture estimated* that of of some 3,000,000 acres in flax, only 2,000 were devoted to fiber flax. This comparatively small quantity has been utilized for binder twine. The report says, "The amount used in making yarn for weaving purposes is negligible."

There are two varieties of the flax plant, differing in methods of cultivation and in the product.

* The Development of an American Linen Industry—U. S. Dept. of Commerce. Special Agents Series No. 122, 1916.

Seed flax is sown sparingly. It is a slender, single-stemmed plant, branching profusely at the top and yielding many seed capsules. This flax seed or linseed is crushed to produce linseed oil, which is used in many industries, chiefly in the preparation of paints and varnishes. The residue makes linseed cake, a valuable cattle food. The stalk contains short, coarse fibers, known as tow, which are capable of producing coarse yarns for bagging, toweling and other low-grade goods. It has not been utilized, however. Vast fields of flax straw have been burned each year, while we have been importing linens from Ireland, Belgium, Russia and Germany. At present, some of the waste fiber is being converted into rugs, such as the Klear flax rugs made in Duluth, Minnesota. Quantities of straw are utilized in making oakum, a material used for insulating purposes and a small amount is used for upholstering. Yet, the conservation of waste flax straw has not proceeded far.

The fiber flax variety is sown thickly. It grows up straight and tall, producing much stalk and little top. Here, flax seed is the by-product.

In America this is grown more sparingly than the seed flax because generally the latter is an easier crop to produce and the machinery for using it less expensive, while a ready market is not wanting.

SUCCESSFUL FLAX GROWING IN WASHINGTON.

To grow fiber flax successfully the proper soil type, selected seed, favorable climatic conditions and careful methods are necessary. A government expert has pronounced western Oregon and western Washington the equal of Belgium for the growing and retting of flax.

Fiber produced in the Willamette valley in Oregon was awarded the highest prize at the Centennial Exposition in Philadelphia in 1876.

Dr. A. W. Thornton of Ferndale, Whatcom county, Washington, has carried on experiments in flax growing for over 25 years, acting at one time as special agent for Mr. R. C. Dodge in charge of fiber investigations of the Department of Agriculture. Dr. Thornton was asked to send some of his flax to a

mill in Belfast where it was made into yarn. The manufacturer wrote the following: "The flax is eminently adapted for thread making or warp yarn and spinning purposes. It is exceedingly strong and works well in the machine. If the flax is grown and manipulated under proper conditions, on Puget Sound, we are convinced that the cultivation of it would be of the greatest importance and in a short time rival the great Belgium district of Courtrai." Dr. Thornton has made flax growing investigations in thirteen counties that are tributary to Puget Sound. He has distributed pedigreed flax seed and directed the farmers in different localities to sow small plots of ground and tend and harvest the flax straw. The climate, soil and quality of water have been found especially suited to the growth and retting of flax.

A large and comprehensive display of Puget Sound grown flax together with samples of flax grown in the famous Courtrai district in Belgium has been placed in the State Museum on the University of Washington campus.

THE MARKETING AND MANUFACTURE OF FLAX.

The work of Dr. Thornton is confirmed by extensive and successful investigation carried on in western Oregon where soil, climate and water are practically identical with western Washington. Thus, the first step, that of flax growing, has been satisfactorily demonstrated.

The problem of marketing the flax, the second step, is analyzed in the following statement from the United States Department of Agriculture. "Something more is needed to set the industry on its feet than a body of farmers to undertake to grow the plant for fiber. There is a necessity for a class of skilled workers who will come between the farmer and the manufacturer in carrying on the operations of retting and scutching. It is futile to expect the farmer to ret and scutch his flax. The farmer is hardly in a position to grow flax save in an experimental way, until he is sure of a market, and the manufacturer, that is, the spinner, is not in a position to make offers of purchases or to name a price, because he is not sure that the farmers can grow flax of the proper standard, or that he can afford to

purchase at any price for his particular manufacturing such flax as the farmer may produce. This simply means that what isolated farmers cannot accomplish alone must be accomplished by the establishment of little local industries. That is to say, capital must establish scutch mills in localities where flax may be profitably grown, farmers of the neighborhood agreeing to produce five, ten or twenty acres of straw each, under the directions, if need be, of the managers of the mills to insure the growth of a quality of straw that will give the proper standard of fiber.”*

Provision for this intermediary between farmer and manufacturer is being made now in Washington by the formation of the National Flax Development Company which will operate in Washington, Montana and South Dakota.

The third step, manufacturing, is in the realm of prophecy. We are at present cut off from our supply of linen goods. After the war, flax fiber might be sent to linen manufacturers abroad, but it seems more logical to suppose that these experienced mill men would prefer to come to the source of the raw material and establish mills.

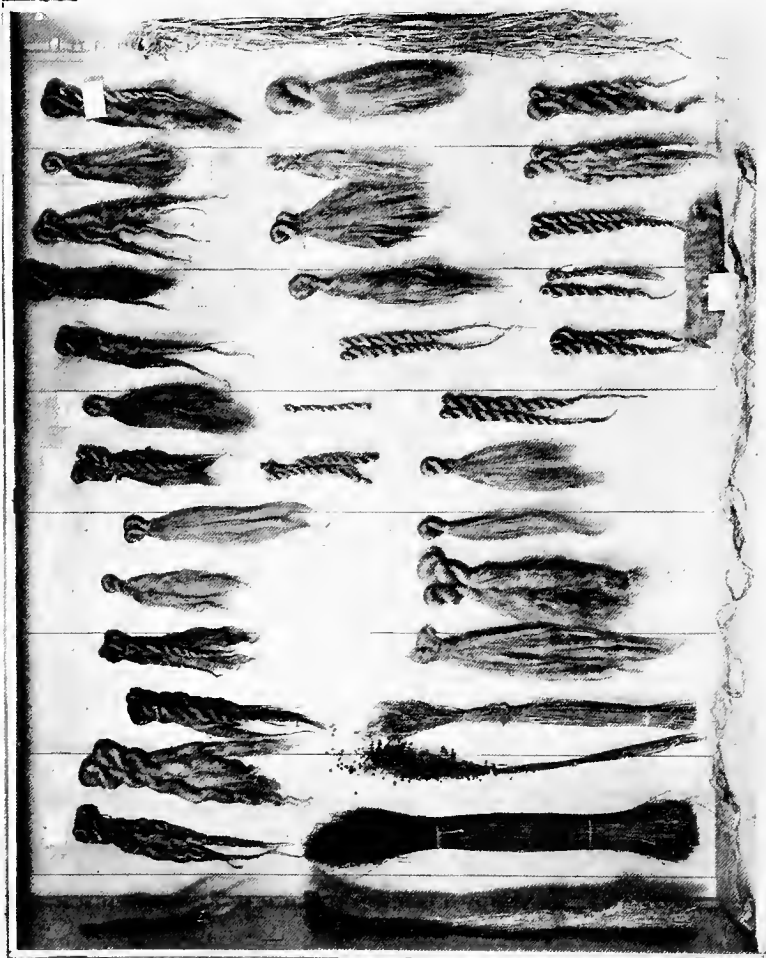
Lack of skilled labor is the most serious difficulty in the production and manufacture of linen but Dr. H. L. Deimel, president of the Deimel Linen Mesh Company of New York, San Francisco, Detroit and Montreal, says that “spinning labor is all that the United States must import. Other classes of labor can be developed with American labor.”

The genius of the American engineer should be brought to bear upon this problem. With the invention of flax machinery the United States might control the future linen industry of the world, and no state offers better prospects for its development than Washington.

POSSIBILITIES FOR RAMIE MANUFACTURE.

The manufacture of ramie fiber is similar to flax. This plant is a species of nettle, native to the Orient. Experiments have proven that it may be grown and prepared in western

* U. S. Dept. of Agriculture—Farmers Bulletin No. 27—Flax for Seed and Fiber. Charles R. Dodge, 1895.



Washington-grown flax, compared with Belgian flax, in University of Washington Museum. Many parts of Washington are ideal for flax production.

Washington. The fiber being resistant to moisture is suitable for ropes and hawsers. It may also produce a fine yarn not unlike linen.

The separation of the fiber from the plant stalk is difficult. So far hand processes only have been employed. This industry has great possibilities, not only with the native grown fiber but with raw material coming directly from China.

FIBER SILK A BY-PRODUCT OF LUMBER INDUSTRY.

In addition to the natural textile fibers already considered, there is an artificial or manufactured fiber, known as "fiber silk" or viscose, which is specially adapted to knitted fabrics. This is in reality a by-product of the lumber industry and the best of material for it exists in Washington in unlimited quantities.

Spruce wood pulp, when ground with caustic soda and treated with carbon disulphide, becomes a viscous fluid which may be forced under pressure through capillary tubes, coming out as fine filaments resembling those produced by the silk worm. These filaments, after being hardened by the action of ammonium sulphate, are united and twisted into yarns. This manufactured product is more lustrous, less elastic and less strong than worm silk. It dyes beautifully and costs, under normal conditions, from one-fourth to one-half as much as the natural silk.

Its greatest use is for knitted fabrics and if manufactured in this state, the product could be utilized in local and middle western knitting mills. It is also much used for designs and stripes in cloth, so would provide an additional material for future textile mills on this Coast.

KNIT GOODS INDUSTRY ALREADY ESTABLISHED.

The one textile industry with a good beginning in the Pacific Northwest is the manufacture of knit goods. There are ten small factories in the state doing successful business. The output consists of sweaters, bathing suits, caps and mufflers and a small amount of underwear. Some of the factories confine themselves to the wholesale trade but many have made their start by selling directly to the consumer. Most of the product is sold locally, but a trade in middle western states is being built up. Eastern mills still supply the stores of Washington

with much of this merchandise, so, the possibilities for developing local trade are still great. Competition is welcomed by these mills in the hope that this may become an important knitting center, thereby attracting related industries.

The first need is for a local dye firm which might supply the colors desired, particularly for sweaters. Large quantities of white yarn might be stored and dyed as market demands suggested. It is a hardship for the manufacturer to gamble on colors six months ahead. The second need is for spinning mills to supply the yarn. Western wools are known as high shrinkage wools. A conservative estimate would be from 40 to 70 per cent. It is wasteful to pay freight on wool plus grease and dirt when it might be scoured here and made into yarn which would be partly consumed by local mills.

POSSIBILITIES IN MANUFACTURE OF HOSIERY.

The manufacture of hosiery has not yet been launched. The need for a local dye establishment is again felt. A good business could be done in wool socks for loggers, miners and mountaineers. A coarse grade of cotton hose for men might precede the making of fine hosiery for women and children. This industry has been successfully carried on in Wisconsin. It undoubtedly has a future here.

CLOTHING MANUFACTURE.

Clothing manufacture in Washington appears insignificant when compared with large eastern concerns. Yet, when the youth of western industries, the relatively small population and the splendid opportunities for general growth are taken into consideration, the prospects for its future development are exceedingly hopeful. There are already factories located in Tacoma, Spokane and Seattle, specializing in working men's garments (overalls, mackinaws, pants and shirts). The Seattle factory consumes the product of the only woolen mill in the state (another is being started in Spokane). There appears to be a good market for cotton dresses and aprons made locally.

SMALL BEGINNINGS PREFERABLE.

In studying the growth of mills both in the east and the west, it appears that the successful manufacturer is invariably the man who is willing to start in a small way, make a good

product and patiently and persistently work for the creation of a market. The war is making business and industrial enterprises more resourceful and perhaps some of the present difficulties may be the means of releasing the genius for invention which will make possible a more extensive production.

Manufacturers who are attracted to Washington because of its natural resources may overcome any obstacles, provided they are willing to travel the same difficult path our forefathers took in developing the textile industries of New England.



Conditions in Washington are ideal for raising Angora goats; from their heavy fleeces an especially fine grade of mohair is produced.

CHAPTER XVI.

WASHINGTON'S MINERAL RESOURCES— NON-METALS.

BY HENRY LANDES,
State Geologist.

The State of Washington is fortunate in having within its confines a large variety of mineral products, which form the bases of many industries. It may be said that the state is characterized by an unusually high percentage of non-metallic products in contrast with the metals. The entire mineral production of the state during the past ten years has amounted to \$13,722,579 annually. Of this about 94 per cent. has been derived from the non-metals. Taking the last census year, 1910, as an example, the production of non-metallic products in the state amounted to about \$15 per capita of population. These products are vitally essential to the entire industrial life of the commonwealth. In most instances only a slight beginning has been made in converting the raw materials into useful objects. As our population increases, conversion of the non-metallic substances into the things necessary in everyday life will come to be one of our most prominent industries.

The primary divisions of our non-metallic products are as follows: (1) coal, (2) clay products, (3) Portland cement, (4) building stones, (5) sand and gravel.

COAL.

The returns from coal amount to one-half the value of the entire mineral products of the state. In this industry about 5,000 men are employed. The coal fields of Washington are among the best to be found in the Northwest. They lie principally in King, Kittitas, Pierce, Lewis, Thurston, and Whatcom counties. Nearly all of the coal areas are now served by railway lines, so that ready transportation is assured. The coal varies from a lignite through the various grades of bituminous coal. Prior to this time the principal demand has been for the bituminous coals, lignite being mined in a lesser degree. With the growing use of pulverized coal for steaming purposes, it is confidently expected that the lignite coals will be in far greater demand.

As a rule the coals of Washington are of easy ignition, produce a hot flame, and burn very freely. They have a small amount of sulphur and a moderate quantity of ash and water. The beds as a rule are thick and several of them frequently are mined at the same place.

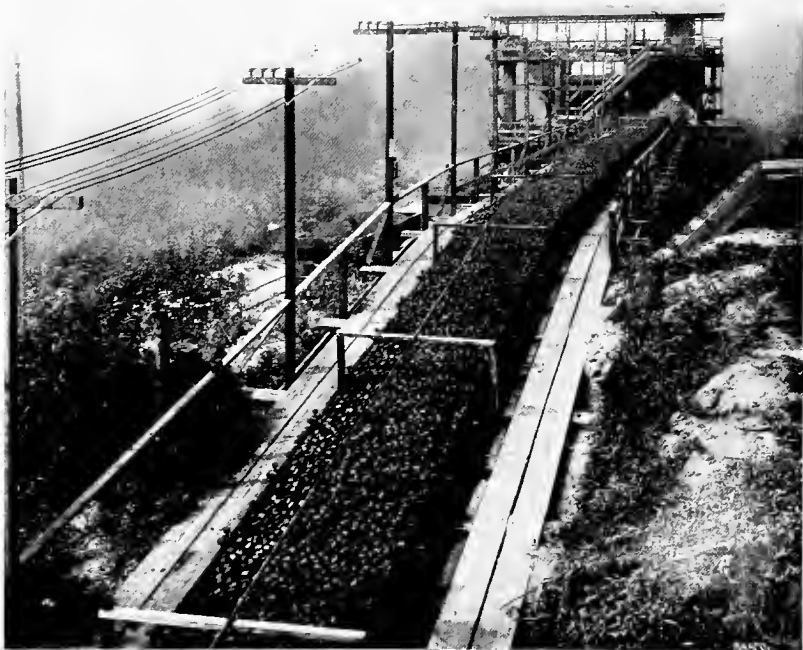
Coal suitable for coking is mined at several places in the state, but especially in Pierce county. As a rule about 5 per cent. of the total coal mined each year is converted into coke. The coke is of a satisfactory quality and sells in the market for a good price.

The annual production of coal in Washington has been about stationary for a number of years. The principal foreign competitor of coal is oil, from California and elsewhere. The chief local competitor of coal for industrial purposes is the abundant water power which the state affords. At the present time, the price of oil is rapidly rising and many industrial plants are now planning to use coal for fuel. It is probable that the output of coal will be greatly increased if the prices of oil continue to rise and it becomes increasingly difficult to obtain. The coals of Washington are quite satisfactory for all fuel purposes. There are large reserves of this fuel as yet untouched. There is no question but what any industry depending upon coal will be able to find in the coal fields of this state an ample supply for a great many years.

CLAY PRODUCTS.

There is scarcely a locality in the state where clays of different grades may not be found. The manufacture of common brick is widespread, being carried on in every community of consequence where brick is needed. The higher grades of clay ware are made in those localities where the best materials are to be found, convenient to transportation and not too far removed from the best markets. The annual value of clay products averages about \$2,000,000. About one-fourth of this is from the sale of common brick which are made at a wide variety of points.

Following common brick, in order of monetary value, we have sewer pipe, vitrified brick, terra cotta, fire-proofing materials, front brick, pottery, and drain tile.



WASHINGTON'S BLACK DIAMONDS.

No. 1. Large coal mill at Renton. No. 2. Cooling belt of a briquetting plant where fine coal is conserved.

The chief competitors of clay wares have been lumber, cement, stone and steel. Because of the increasing use of reinforced concrete in structural work the production of common brick is about stationary. There has been a notable increase from year to year in the production of vitrified brick, fire-proofing and terra cotta, as well as sewer pipe. The increased manufacturing of these things is largely due to the rapid and permanent growth of our cities where such materials are vitally necessary. The growing use of drain tile is due to the reclamation of the swampy areas where the soils are too valuable to be longer neglected. The manufacturing of clay wares represents an industry which becomes increasingly important with the growth of population. As is usual in a new community, only certain basic things were made at first, such as common brick. With the development of the towns and cities there came a demand for front brick, terra cotta, fire-proofing, paving brick and sewer pipe. As the state increases in population and wealth there will be an ever growing demand for the higher grades of clay goods, such as pottery, art goods, and those products of maximum value. Within the state there are deposits of clays suitable for the making of wares of all kinds and descriptions. With fuel convenient and an active and expanding demand for the products, it is evident that the manufacture of clay goods will soon come to be one of the greatest, if not the most important, of the manufacturing industries in the state along mineral lines.

The clay wares now manufactured are made from a wide variety of clays. Some of the clays are secured at the surface where they are essentially a part of the soil. In the northern portion of the state most of the clays are of glacial origin, while in other localities the surface clays have been formed by the decomposition of the bed rock. Except for common brick a large percentage of the clay products are made from clays derived from the bed rock formations. In some instances the clays are taken out of the great beds by the usual quarry methods. In other places the different varieties of clays are secured from the strata at points considerably under cover by methods of underground mining.

On the whole, the clays of the state are essentially inexhaustible. Some of the finer grades of clay are as yet practically untouched, because of the slight demand that has existed for the higher grades of ware. As the population of the state enhances in number and in wealth, those manufactured articles now brought from without will be made in Washington in an ever growing quantity.

PORTLAND CEMENT.

The materials used in Washington in the manufacture of Portland cement are limestone and clay. Limestone occurs in all of the counties along the northern boundary of the state and in Chelan, Skagit, Snohomish, and San Juan counties as well. Clay suitable for cement making is very widespread in occurrence and is much more abundant than limestone. For a number of years all of the cement that was used in the state was brought from elsewhere, much of it from Europe and some of it from the eastern states and California. The first cement in the state was manufactured in Skagit county, at Concrete, in a plant which began operations in 1907. At the present time there are two factories at Concrete, one at Bellingham, one near Spokane and one at Metaline Falls, in Pend Oreille county.

The annual production of Portland cement now amounts to nearly \$2,000,000. For a number of years it has not been necessary to import any cement and the five plants in the state make an ample amount for local use. The opportunities for the establishment of other plants are excellent as far as the location of desirable materials is concerned. The demand for cement is growing with great rapidity because of its increasing use in highway construction and in re-enforced concrete work. It is an industry which will always be a growing one as long as the state increases in the number of people, and as long as great projects of engineering must undergo construction.

BUILDING STONES.

Building stones in an increasing quantity have been used since early days in the settlement of the state. The use of building stones has suffered in a degree because of the active competition of lumber, cement and brick. The principal build-

ing stones that are used in the state are granite, sandstone and basalt. Granite is secured very readily in the northern counties of the state and quarries are in operation around Spokane and at two or three points on the Great Northern railway in Snohomish county. While sandstone occurs in many localities, quarries to obtain it have been opened up chiefly near the cities of Puget Sound. The best sandstone quarries today are those at Tenino, in Thurston county. Other quarries are near Wilkeson, in Pierce county, Chuckanut, in Whatcom county, and on some of the San Juan islands.

Basalt is an abundant rock in southeastern Washington, where it is frequently used as a building stone, mostly for foundations. The primary use of basalt is in road building, where after crushing it is used in macadam construction. It is especially desirable in those localities where gravel can not be readily obtained for road surfacing. In addition to stone for building purposes it has always been in considerable demand for sea walls, jetties, and for use as rip-rap. The total production of stone in past years has amounted to about \$200,000 annually. The supply of granite, sandstone and basalt will never be exhausted.

Marble of good grade occurs in the counties of northeastern Washington, and from time to time this material has been taken out and put on the market. Limestone has not been used as a building stone but has its chief use in the burning of quicklime, and in the manufacture of cement. The building stone industry is one that will always increase rather than diminish. For certain purposes no substitutes have been found that can replace stone. As our industrial enterprises become more numerous and the cities increase in size the stone industry will become greatly enhanced. At many localities new quarries will be developed and many new enterprises installed.

SAND AND GRAVEL.

The annual production of sand and gravel for the past ten years has amounted to about \$400,000. The use of sand and gravel is intimately connected with the fluctuations in the amount of building construction and the quantity used neces-

sarily varies from time to time. Because of the increasing use of cement in structural work and particularly in road building, the demand for sand and gravel has grown correspondingly. All over the state the highways are being improved and gravel is very generally used in road surfacing.

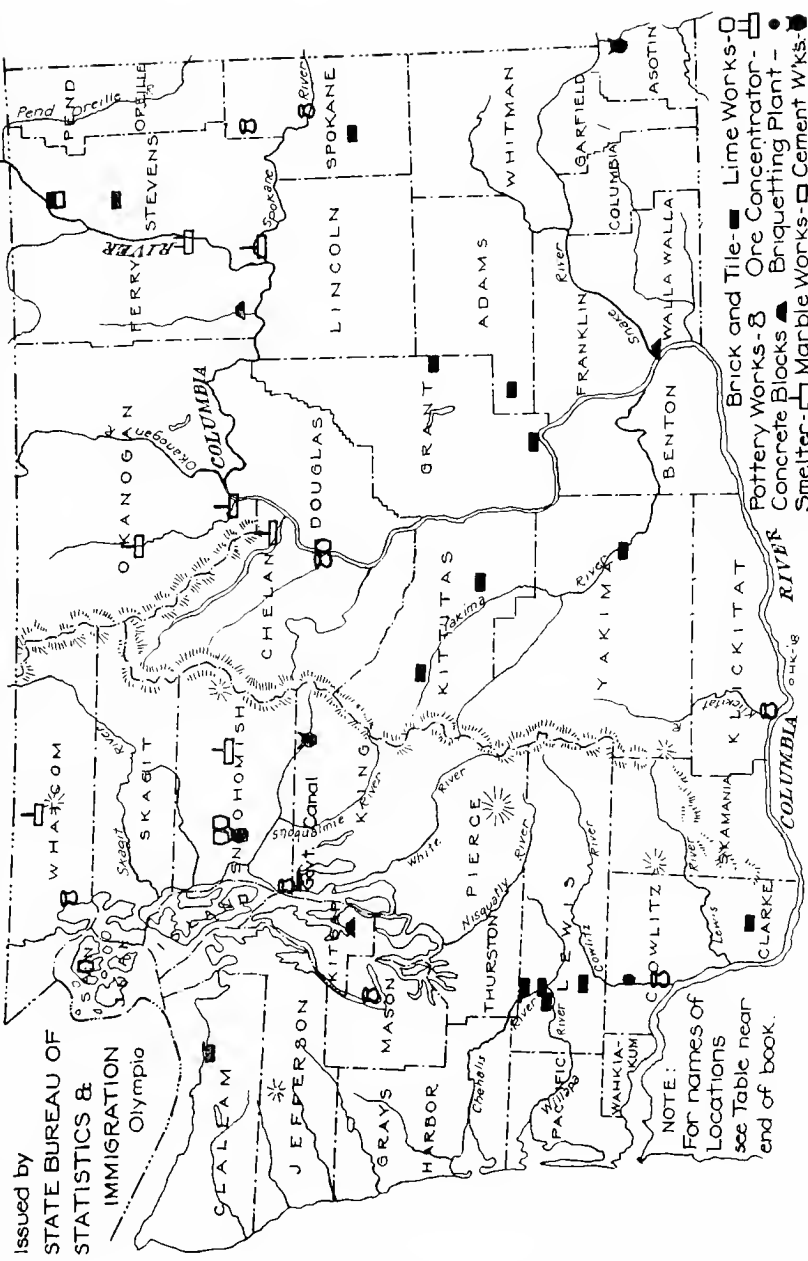
Sand and gravel are widespread in their occurrence in the state, the only localities where they are not abundant being in the southeastern and the southwestern corners of Washington. It so happens that in the vicinities of all of the large cities banks of sand and gravel are abundant and excellent materials are readily secured. The furnishing of sand and gravel is a well developed industry and many firms are engaged in this work. About Puget Sound the great beds of sand and gravel are substantially inexhaustible and available for all kinds of structural work. No industry which is dependent upon either sand or gravel need hesitate about being able to secure first class materials of this kind. In general the sand and gravel are cheaply secured and easily delivered wherever desired for use. As a rule the sand and gravel are very fresh and hard, and ordinarily very clean. Sometimes washing is resorted to, but frequently it is quite unnecessary.

There are many useful non-metallic products which have not been mentioned. Silica, in the form of diatomaceous earth, occurs rather frequently and some of it of excellent quality has been placed on the market. It is found abundantly in both eastern and western Washington and as its use widens it will become increasingly in demand. There are many mineral springs in the state from which water for table use is prepared for the market. Some of these are of marked medicinal value and many which are not now commercially utilized will be marketed in the future.

It is safe to say that all of the non-metallic products that have been mentioned, with others, are but in the infancy of their development and that in time to come they will play a prominent part in the industrial and commercial life of the state.

LOCATIONS REQUESTING MINERAL PRODUCTS FACTORIES

Issued by
STATE BUREAU OF
STATISTICS &
IMMIGRATION
Olympia



NOTE:
For names of
Locations
see Table near
end of book.

- Brick and Tile -
- Lime Works -
- Pottery Works -
- Ore Concentrator -
- Concrete Blocks -
- Briquetting Plant -
- Smelter -
- Marble Works -
- Cement Wks. -

CHAPTER XVII.

WASHINGTON'S MINERAL RESOURCES—METALS.

BY MILNOR ROBERTS,

Dean of the College of Mines, University of Washington.

All industrial growth depends to a greater or less extent upon metals. If a state is lacking in natural resources of the metals it must look elsewhere for at least a limited supply of them. If it possesses the metals in useful quantities or is a center for tributary regions which have large amounts of them, the possibilities favoring its industrial advancement are greatly enhanced.

FAVORING CONDITIONS.

Washington not only has a liberal supply of metal resources of its own but is adjacent to territory where other very rich mines are located. Then, too, certain favoring conditions, some of which are natural and others due to the state's development, exert an encouraging influence upon the mining of its own minerals and place it in position to enjoy the full advantage of proximity to other productive territory. These conditions, which have been quite fully discussed elsewhere, include especially: a strategic location and the resulting extension of transportation facilities; broad trade relations with the outside world; a more or less advanced stage of development in certain other important industries; and, what is of prime importance to mining and metallurgical development, an unlimited supply of cheap power.

WASHINGTON A CENTER FOR ORE TREATMENT.

The effect of these and other favoring conditions of a like nature is to make Washington a center for the treatment of ores brought from widely scattered sources. The Pacific Coast states, British Columbia, Alaska, the Orient and South America are the principal regions from which regular shipments are received. In addition to the primary operations of smelting crude ores and concentrates, the Northwest is building up secondary industries of a metallurgical nature, such as refining metals and treating scrap materials. Judging from the present outlook metallurgical operations are likely to outstrip the purely mining

side of the mineral industry within the actual borders of the state, unless ore deposits now wholly unknown should come to light. Adjacent districts will furnish large quantities of ores for years to come, in addition to the local supplies.

PRINCIPAL METALS MINED.

Gold, silver, copper, lead and zinc are the principal metals mined in Washington. The amount of each varies considerably from year to year, but for the past few years the total output of these five metals has been increasing. Most of the gold comes from quartz mines located in the northern half of the state, the Mount Baker district and Republic being the principal producers. Okanogan, Stevens, Chelan, Kittitas, Snohomish, King and Clallam counties also yield gold. The total gold production for 1916, according to advance figures prepared by the United States Geological Survey, was 27,944.06 ounces.

In passing, it is interesting to note that most of Alaska's gold output is received at the United States assay office in Seattle, the receipts since the establishment of the office being a quarter of a billion dollars' worth of the yellow metal.

Silver is obtained from thirteen counties, along with the gold, copper, and lead. The total production for 1916 was 335,121 ounces.

Copper is widely distributed throughout the mining districts of the Cascades and northeastern Washington. Outcrops of the sulphides, especially chalcopyrite, are found at very numerous points, a fact which has resulted in the location of thousands of claims. The great majority of these locations are in mountainous regions, difficult of access, where only a very rich ore could be worked at a profit, unless the deposit proved to be of such size as to warrant building a transportation system especially for it. Snohomish, Stevens, Okanogan, Ferry, Pierce, Skamania and Asotin counties are active in copper, while in Chelan, Skagit, Whatcom, Pend Oreille and other counties explorations are being carried on. The state's yield in 1916 was 2,645,022 pounds. The chief center of copper smelting for the Pacific Northwest and Alaska is Tacoma, where the Tacoma Smelting Company smelts and refines one-twelfth of the copper output of the United States.

Lead has been mined in the state in considerable quantities at times in the past; in the last two or three years several mines in northeastern Washington have again brought up the production of lead, the total for 1916 being 5,399,274 pounds. Lead mining has been stimulated by the re-opening of the Northport smelter which lay idle for several years.

The production of zinc has risen along with that of lead, reaching a new high figure of 1,693,734 pounds in 1916. The



UNDERGROUND WEALTH.

Interior of a tunnel in mining district north of Spokane, showing how the ore has been taken out and timbers placed to prevent cave-ins as the work proceeds.

remarkably high prices for zinc which prevailed throughout 1916 gave a handsome margin of profit which cannot be attained during the year 1917.

MINOR METALS.

Arsenic in the form of arsenopyrite is found in several Washington camps. It was smelted for a number of years at Everett

from the gold-silver ores of Monte Cristo, Snohomish county. Later the Everett plant was abandoned and a new one erected at the Tacoma Smelter where refined white arsenic of the highest grade is now made.

Antimony mines have been opened in King, Chelan, Okanogan and other counties, from most of which a few shipments have been made, although none of the properties have become regular producers. The Okanogan ore was smelted in a furnace located at Tonasket, while a plant at Seattle treated ores from this state, Alaska and elsewhere.

Mercury ore is found in Lewis and Chelan counties. Quick-silver was produced in 1916 in a furnace at Morton from cinnabar of excellent grade which was mined nearby. Development of the properties near Blewett is taking place.

Tungsten has been known for some years in Kittitas county and at Deer Trail, Stevens county, where some production has been made in the past. When the price of this uncommon but peculiarly useful metal rose with the war demand, the hills were scoured for wolframite and scheelite. New deposits were found and forgotten prospects were opened anew, some of which are being developed further.

Tin was discovered years ago near Spokane but the deposit was not extensive. Alaska tin is smelted in an electric furnace at Seattle.

Molybdenite is an unknown mineral in many parts of America, but in Washington it can be found at numerous points in the Cascade Mountains and in the northern tier of counties. Most of the occurrences are either sporadic and small, or else of too low grade to be worked. Near Lake Chelan, however, the Crown Point mine developed a vein of high grade molybdenite, erected a mill on its property and operated for several seasons. Other properties in the state are likely to make some production.

IRON ORES.

Washington's iron ores have been worked on a small scale at different times in the past. Recently the old Irondale blast furnace plant has been rebuilt by its present owners, the Pacific Coast Steel Company, and the smelting of iron has begun again.

The company is purchasing ores from all available sources, a plan which will result in determining how dependable the iron ore deposits of the Northwest coast really are. The Pacific Coast Steel Company has operated a steel plant and rolling mill in Seattle for many years with great success, buying scrap iron from South Chicago, Birmingham and the Orient. Three open-hearth furnaces are kept in constant operation.

An electric furnace for the treatment of iron ores was erected last year in Skagit county. Manganese ores from Lakeushman in the southern part of the Olympic range have been smelted recently in Tacoma at the plant of the Bilrowe Alloys Company. The Seattle Smelting Company is making ferromanganese from Northwest ores in electric furnaces located at Van Asselt Station, Seattle, while the Rothert Process Steel Company is nearly ready to produce electric steel. Other plants of a like nature are being definitely planned in the state.

According to a recent announcement by prominent mining operators a large plant is to be erected in the immediate future near Seattle for the complete treatment of iron through the several stages from raw ore to finished products of steel. The project will include blast furnaces, a steel plant, rolling mills, by-product coke ovens and the usual accessory works. Washington coal will be used and the supply of iron ore will be drawn from this state, British Columbia, Alaska and other Coast sources.

TOTAL OUTPUT.

To summarize, the total value of the gold, silver, copper, lead and zinc mined in Washington during 1916 was \$2,048,350. For the same period, however, the Tacoma and Northport smelters produced a far larger total made up of copper, lead, gold and silver which was mined in part in districts outside the state. The grand total of metallic production would include also the steel and the minor metals above described.

INDUSTRIAL RESEARCH.

Investigations conducted for the past year by the Bureau of Industrial Research of the University of Washington have developed many new facts concerning the iron smelting situation and have served to summarize the information as to deposits of iron ore in the Pacific Northwest, British Columbia and Alaska.



SCENES FROM THE STEEL INDUSTRY AT SEATTLE.

No. 1. Part of 400,000 rod order manufactured in 20 days. No. 2. Pouring ingots. No. 3. Large plant in operation.

The results are encouraging toward the establishing of an iron industry in this region. Metallurgical coke is being made from Washington coals in beehive and by-product ovens. Inasmuch as a large and growing local market exists for both iron and steel, the future of the industry in this state looks bright.

EXPERIMENT STATION AT UNIVERSITY OF WASHINGTON.

In 1916 the United States Bureau of Mines established one of its mining and metallurgical experiment stations at the University of Washington, to work in co-operation with the College of Mines. Six of the Bureau's experts located at the station are now engaged in studying the particular problems that are of the greatest importance to the mining and metallurgical industries in the Northwest and Alaska. In order to expedite the work of investigation the state has provided additional equipment for the laboratories of the College. The state is also supporting five fellowships, the holders of which devote their time for a year to solving problems arising within the state. A great step forward was taken with the establishment of the station by the federal government, and the appropriation by the state legislature of funds for investigating problems affecting these two basic industries, mining and metallurgy. The territory allotted to the Northwest station embraces the Pacific Northwest and the coast regions of Alaska. Sub-stations are maintained in Idaho and Oregon.

INVESTIGATIONS BY FELLOWSHIP HOLDERS.

The present fellowship holders, all of whom are required to be technical graduates with practical experience, are working on a number of important topics, the principal one being electro-metallurgy. For this industry a source of cheap and dependable power is a prime requisite and, as already stated, hydro-electric power is one of the state's greatest resources. This fact, coupled with the item of favorable location, makes it practically certain that electro-metallurgical industries will increase here. The electrolytic copper refining plant of the Tacoma smelter, electric smelting of tin ore, electric furnaces in iron works and other lesser operations are present examples that indicate the future possibilities.

The salmon and fruit canneries of the North Pacific Coast make a large quantity of tinplate scrap which ordinarily goes to waste. An expert of the Bureau assisted by a fellowship holder is now engaged in attempting to find a means of conserving this material. Another topic is the treatment of lead-zinc ores by electrical methods which, if they can be worked out successfully, will mean a vast saving.

The mineral resources of Washington are being thoroughly studied by another fellowship holder. All published articles which give information on the subject are being listed and indexed. A separate map of the state is being prepared for each mineral substance, showing all localities where each is found and the plants in which it is treated. Field studies will be made of prominent localities regarding which the reports are incomplete. Finally a summarized report will be prepared which will bring up to date all available knowledge of the state's mineral resources.

Methods of treating the ores and other crude materials will furnish the subject-matter of another report. The extensive knowledge possessed by the Bureau of Mines will be applied to local problems with the object of aiding development, reducing treatment losses and avoiding expenditures in directions which are not likely to lead to useful ends.

In preparing Washington coals for market, various processes are used at different mines, depending upon the particular requirements of each coal. Broad investigations into the nature, preparation and uses of coals in all parts of the country have been carried on by the Bureau of Mines, which will now undertake to give special aid to the coal industry in Washington. Under one of the fellowships a report will be made upon the local methods of treatment in order to give the Bureau a basis for giving detailed advice. The saving of by-products in coking, the use of powdered coal as fuel and the briquetting of coal are other topics to be taken up later.

SOURCES OF INFORMATION.

There are several sources of information regarding the mineral resources of Washington, some of which are readily available. The United States Geological Survey has published extensive

reports on those areas in the state which are of the greatest economic importance. A bulletin may be had from the Director at Washington, D. C., which lists all the known mineral occurrences in each state. A finding list, published anew from time to time and sent to the larger libraries, furnishes a quick means of locating articles relating to a particular mineral or locality.

The United States Bureau of Mines, although established for less than a decade, has already issued hundreds of papers, some of which describe Washington minerals and mines. The Washington State Geological Survey has published reports, bulletins, maps and a bibliography, which may be obtained from the State Librarian at Olympia.

Specimens of the principal ores, coals and useful rocks of Washington may be seen in the form of collections which are on exhibition at nearly all the accredited high schools in the state. These collections, which contain one hundred thirteen specimens each, were prepared in 1916 by the College of Mines and distributed free by the Extension Division of the University. A bulletin of ninety-six pages which accompanies each collection describes the specimens and their sources.

Inquiries regarding the mineral industry may be addressed to the College of Mines, University of Washington, Seattle.

ADVANTAGES APPARENT.

From the foregoing statements, it must be apparent to a manufacturer desiring to come to the State of Washington and engage in an industry requiring for its success a supply of mineral products, that the prospects are favorable for finding the necessary materials in Washington or for bringing them at minimum expense from neighboring territory, and that the facilities for working them into proper shape for utilization are being rapidly perfected. The expert advice proffered and the assistance in the form of investigation placed at one's command by state and federal authorities should be considered as further encouragement in undertaking any industrial enterprise of merit. Under such conditions the chances for failure are reduced to the lowest possible minimum.

CHAPTER XVIII.

FERTILIZER RESOURCES OF WASHINGTON.

BY CHARLES A. NEWHALL,

Consulting Chemist, Seattle.

Member American Institute of Chemical Engineers.

Not the least prolific field for industrial effort in the State of Washington is found in the utilization of the vast quantities of fertilizer materials which are at present being neglected, and in the more thorough conservation of those that are being either wholly or partially wasted. The value of such materials and the importance of using them to the fullest extent is especially emphasized today, when the usual sources for some of the elements are no longer available; so that the discovery of other supplies, or of appliances for obtaining them, will mean greater progress in the agricultural development of the country, and added wealth for the manufacturers who solve the problem of most cheaply extricating the elements from the materials containing them.

It is to point out some of the advantages which Washington offers for such work and to encourage, if possible, more activity along such lines on the part of those in a position to follow them, that the following paragraphs are written.

FERTILIZER ELEMENTS.

The fertilizer elements needed for plant growth are chiefly nitrogen, potassium and phosphorus. These elements the plant takes out of the soil and sooner or later the soil is exhausted, and can no longer sustain healthy plant life. To keep a soil fully productive the three elements must be put back into the soil in some form, whereby they may again be available for the plant.

These three fertilizer elements occur on the earth in many different forms and combinations, only a few of which are available for immediate use by the plant. It is not sufficient that a material simply contains potassium—for instance; this potassium must be in readily soluble or “available” form, so that the plant can use it. Great chemical industries have been built up



A kelp bed at Neah Bay. Annual kelp crop of Puget Sound is about 390,000 tons, offering great possibilities for the manufacture of fertilizer.

for the purpose of converting "unavailable" fertilizer elements into "available" forms and combinations.

NITROGEN.

Nitrogen is the element most necessary to plant growth, and it is the most abundant of all the elements that go to make up the substance of the earth; yet only a very small portion of this nitrogen is available for fertilizer. The vast quantity of free nitrogen in the air is not "available" for plant use until it has been converted into a combined form.

The world's supply of combined or available nitrogen is strictly limited, and is being depleted far more rapidly than it is being replenished by the slow processes of nature. Hence, chemists have for years past been working on the problems of "nitrogen fixation," that is, of making available the free inert nitrogen of the air.

The solution of this problem has formed one of the most spectacular developments of modern chemistry. First worked out on a commercial scale by American chemists, and then put on a wonderfully successful commercial basis in Norway, this "nitrogen fixation" business has grown within ten years from a tiny plant to one of the world's greatest industries.

"ARC PROCESS."

Several processes for nitrogen fixation are now in use. The "Arc Process," whereby air is passed through a high temperature electric furnace, is dependent for its successful operation on cheap electric current—current costing not more than \$10.00 per horse power year.

The "Arc Process" is technically quite simple and can be operated with a comparatively small investment in furnaces and plant equipment, outside of the investment in power development. The essentials for its successful operation are very cheap power, air, and some basic chemical, such as lime or soda. It can be worked to advantage on a small scale as an outlet for the "off peak" current from established power plants that derive their main income from the operation of public utilities.

A plant using the "Arc Process" is now purchasing the surplus current from the city of Tacoma power system, and

converts atmospheric nitrogen into commercial products. The power is sold by the city at a rate of \$0.0015 per kilowatt hour.

CYANAMID PROCESS.

The second method of converting the inert atmospheric nitrogen into usable fertilizer form is the "Cyanamid" process. Immense quantities of cyanamid fertilizer are now made in many places in Europe and at Niagara Falls in Canada. The process is not absolutely dependent on very cheap power, as is the "Arc Process," though much power is used in making the calcium carbide, which is the substance used to fix the nitrogen.

High grade coke is now used exclusively along with lime in making calcium carbide. Charcoal could be used, however, and eventually this use is likely to provide an outlet for the charcoal obtained by the distillation of our lumber and logging waste. It is interesting to note, in this connection, that the numerous attempts to work up the timber waste by distillation have all failed, largely on account of inability to sell the charcoal. Good markets can be found for the distillation liquids, but this market does not furnish sufficient income to make a plant a commercial success; the sale of the charcoal would furnish the profit. Thus the commercial future of our wood-products industry is closely associated with the cyanamid industries.

NUMEROUS OPPORTUNITIES IN WASHINGTON.

Reasonably cheap power, lime, carbon in the form of high grade coke or charcoal, and air are the essentials for the production of fertilizer by the "Cyanamid" process. In Washington we have the makings of a great cyanamid industry, once the business is developed on broad gage business lines so as to include the wood waste industry. We have numerous locations where cheap power can be developed. We have great quantities of very high grade limestone, cheap fuel and a tremendous timber waste from which to obtain the carbon.

Turning to our natural supplies of available nitrogen, the coals of this state contain, on an average, approximately one per cent. of their weight in nitrogen. When the coal is heated to make coke or gas, the greatest part of this nitrogen can be

recovered in the form of ammonium sulphate—a valuable fertilizer material.

The gas works of our larger cities are now collecting many tons of this nitrogen, but in the coke ovens in the State of Washington great quantities of valuable nitrogen materials are being wasted. Eventually, in this state, as is now being extensively done in Germany, coal will be distilled for the nitrogen and the valuable oils and waxes. Some of our coals seem particularly adapted to this use.

FISH WASTE.

Washington's greatest contribution to the nitrogenous fertilizer supply is in the form of dried and treated "fish scrap" or



Cod-fish packing plant.

"fish guano." The greatest part of this guano is supplied by the whaling companies. One company was formed for the purpose of working up dog fish and other worthless fish.

The Pacific Products Company of Seattle and Port Townsend is working up the worthless fish as well as salmon cannery waste. Approximately 1,000 tons of prepared fish fertilizer is their annual output. Three and six-tenths tons raw fish make one ton fertilizer, this containing approximately 11 per cent nitrogen and 14 per cent bone phosphate.

For years the salmon canneries threw away a tremendous tonnage of scrap—some 40 or 50 per cent of the weight of the

fish—heads, fins, viscera, etc. Nowadays, much of this scrap is saved and, when properly treated, forms a very fine fertilizer material containing both nitrogen and phosphorus. Processes have been developed whereby it is possible for cannery men to partially cure their scrap and collect enough for shipment to a central treating plant.

Wet kelp contains on the average about 0.19 per cent. nitrogen and when dried, about 1.18 per cent., practically all of which is available as fertilizer material. At the present market value of fertilizer nitrogen (\$5.35 per unit), the nitrogen in one ton of dried kelp would be about \$6.31.

POTASSIUM AND KELP.

This brings us to the consideration of potassium, the second element needed for plant growth.

Kelp and several other sea plants contain relatively large quantities of potassium. Under the present abnormal conditions of the chemical trade, these plants can be worked at a profit for their potash content. Even under normal trade conditions it seems probable that Washington kelp can be worked at a profit to supply a local fertilizer market.

Raw kelp contains on the average 86.4 per cent. water, with only 2.8 per cent. potassium chloride (equal to 1.8 per cent. K_2O), 0.19 per cent. of nitrogen and 0.03 per cent. iodine. The balance is organic matter and salt (sodium chloride). The air dried kelp may run as high as 18 per cent. potassium chloride (11.45 per cent. K_2O) and the calcined kelp anywhere from 25 to 65 per cent. potassium chloride (15.8 to 41 per cent. K_2O). From the calcined kelp it is possible to get a very high grade potassium chloride—99 per cent. pure—(62.5 per cent. K_2O). Only about two-thirds of the total potash in the original kelp can be recovered in this high grade form and it is far too expensive for use in the fertilizer trade, but would find a market in the chemical trade.

Under normal conditions it has been conservatively estimated that dried kelp for fertilizer use would be worth about \$12.00 per ton, and that over six tons of the green kelp must be harvested to make this one ton of dried kelp. Government experts

have estimated the annual kelp crop of Puget Sound to be about 390,000 tons, the greatest beds lying along the American shore of the Strait of Juan de Fuca and along Smith and San Juan islands. In addition to this, it is estimated that the kelp crop of southeastern Alaska from Dixon entrance to Chatham strait amounts to 7,833,000 tons. With this abundant supply of free material to be had for the harvesting, the industry offers an excellent field for men who can develop it along practical and scientific lines.

It has been suggested that the kelp industry could be combined with the fish waste industry, and both be worked to an advantage here in the North Pacific district. The same drying and handling equipment would serve both industries. It only remains to devise an efficient kelp harvester, suitable for rather small scale operations. This suggestion is worthy of careful consideration by engineering chemists and by men interested in the fish business.

POTASH FROM MINERAL SOURCES.

America is very rich in potash, but the greatest part of this potash is located in rocks, in combinations with silicon, aluminum and other elements. In this combination, the potash is insoluble and so it is of little or no commercial value. To be of value, potash must be in soluble form, such as the combination with chlorine or sulphur and oxygen. It is in these soluble forms that potash is found in the great Stassfurt deposits in Germany and in such form the potash is available for commercial use.

Our mineral potash supply may be classified under two headings; first, the saline deposits, and second, rock combinations. The saline deposits are relatively unimportant because of their small extent. By far the most promising source of potash lies in the second division, namely, the igneous rocks.

There is an incalculably great tonnage of potash in the feldspar, which constitutes one of the chief minerals in the granite rocks occurring in practically every district of the country. It is easily possible to get rock in quarry size operations that will run 10 per cent. potash. The pure feldspar which occurs in quantity in many places will run as high as 16 per cent. potash.

Tailings from certain gold and copper ores run very high in potash,—4 to 13 per cent. K_2O .

Until recently, no practical process had been perfected by which this potash could be separated and collected without excessive expense, but a short time ago the Riverside Portland Cement Company of southern California, in an endeavor to eliminate the dust from their plant, reached a solution. The dust from all parts of the cement plant is drawn through chambers



Whale products plant at Grays Harbor.

highly charged with electric current and every part of the dust is precipitated, leaving only inert gas to escape into the air.

Before the installation of the process, the cement company was throwing several hundred tons of dust into the air every 24 hours. Now it is found that this dust which is collected by the electrical process contains practically all of the potash that occurred in the original raw materials.

This dust contains approximately 1 per cent. of potash. It is now being run back into a special kiln where the potash is volatilized. The potash leaves the kiln along with some dust and is collected in the electric precipitation chambers. This dust contains 10 per cent. potash, in the form of potassium sulphate, and is now finding a ready sale to the very orange growers who before attempted to shut down the cement companies because

the dust injured their orchards. About 4 tons of dust containing 10 per cent. potash is now being produced each day. All this means that the cement plants of the country will eventually be the potash producers, for it is entirely feasible for cement plants to select raw materials that run high in potash; in fact many of the plants now in operation are throwing away many tons of valuable potash-bearing dust every day. The cement plants of this state are throwing away enough potash to more than supply local potash requirements.

The experience in Riverside has shown conclusively that the installation of the electric dust collectors is a paying proposition and will return a good percentage on the investment. The value of the dust as a raw material more than pays for operating the process and allows for interest and depreciation on the investment. This leaves a clear profit on the income from the sale of the potash bearing dust.

At the present time there are four cement plants on this continent that are recovering potash. It has been shown that raw materials containing as low as 0.1 per cent. potash can be worked and a satisfactory recovery made.

Great quantities of granitic rocks, copper and gold ores occur in the State of Washington and there is not the least doubt that the future development will show that these rocks contain potash in quantities. The commercial development of the potash bearing rocks depends entirely on the cost of transportation of such rock to the existing cement plants; only the future can tell how far this development will extend in this state.

PHOSPHORUS.

Washington has no phosphorus bearing rocks in commercial quantity, so far as known. The phosphorus that occurs with the nitrogen in the "fish scrap" can be our only contribution. In Idaho, however, vast quantities of phosphorus rock—one of the greatest deposits in the world,—will eventually supply the needed material for a complete fertilizer industry.

Thus, with the Idaho phosphates and our own potash and nitrogen resources, we have the basis for a great fertilizer industry.

CHAPTER XIX.

MISCELLANEOUS MANUFACTURING POSSIBILITIES.

In addition to the opportunities described under the different general headings in the foregoing chapters, there are openings for many miscellaneous manufacturing plants, too varied in nature to warrant separate classifications, although many of them are just as important individually as some of those already mentioned. These include such lines as fish products, tanning and leather manufactures, rubber goods, glass, sugar, starch, strawboard and paper, briquettes, mattresses and many minor lines of endeavor.

Some of these are still more or less in the experimental stage of development in the state, or else have not been introduced at all; while others are side issues to some of the more important industries already in existence.

FISH PRODUCTS.

Salmon canning, as already stated, is by far the most important branch of the fishing industry in Washington, but the canning of oysters, clams and crabs also assumes considerable proportions. The total output of food fish and shell fish for 1913 was estimated by the state fish commissioner to be close to \$20,000,000, while in 1916 it probably reached \$13,000,000. Puget Sound, Grays Harbor and Willapa Bay are the principal localities for the business although some is carried on along the Columbia river.

While, as indicated by the reports received by this Bureau, there are undoubtedly openings along Puget Sound and on the Columbia river for new salmon canneries, the greatest need seems to be for plants which can utilize varieties of food fish not extensively used at present.

Among such fish are halibut and cod. The halibut banks and cod fisheries off the mouth of the Straits of Juan de Fuca and in Bering Sea yield heavily in these fish and it is claimed that the supply is unlimited. Much of it is brought to Washington plants to be cured and canned. At Poulsbo the largest cod packing plant of the Pacific Coast is located.

Recently the much despised dogfish, which exists in unlimited quantities, has undergone a change of name and as "gray fish" is being canned in large amounts. The octopus or devil fish is a luxury much esteemed by the Japanese. Thousands of these creatures can be caught in Puget Sound. Smelt by the millions run annually up the Columbia river and into the Cowlitz, and silver smelt and herring abound in Puget Sound: but the packing or preserving of these fish is far below their possibilities.

Among the Scandinavian population of the state there is a considerable demand for many fish products which were formerly imported in large quantities from Norway. It would seem that a near substitute for Norwegian fishballs could be produced from some of the fish of these waters. Certain varieties of fish found here can be salted or pickled, smoked or dried and there is still a wide field for development in this industry which is commended to the attention of men who have had experience in this line.

In this connection might also be mentioned the whaling industry which offers attractive openings. One company now operates an extensive plant at Bay City, on Grays Harbor, where all parts of the big sea mammals are utilized. Formerly, whales taken at sea were cut up and the oil extracted on the whaling vessels, so that much of the carcass was wasted; but at this factory, the body is towed to shore and worked up into various by-products. Whale meat, too, has been marketed in considerable quantities and promises to become a staple article of food in Pacific Coast states. In two days whaling during the month of August, one boat took six sperm whales valued at \$15,000, and conveyed their catch to this factory.

TANNING AND LEATHER MANUFACTURE.

The manufacture of tannic acid from the bark of the western hemlock and the tanning and manufacture of leather are allied industries for which conditions are very favorable at many points in this state. As mentioned in another chapter (page 87), the western hemlock is rich in tannic acid of a high grade, which, according to the estimates of experts, can be cheaply extracted and, when combined with catechu or "cutch," a tan-

ning extract obtained from China, which is available here at a minimum cost, the very best results are obtained.

An exhaustive paper on "Western Hemlock" by Edward J. Hanzlik, Forest Examiner, and Howard B. Oakleaf, in charge of forest products, U. S. Forest Service, published October, 1914, says:

"Of the 2,200 tons of bark used annually in the Oregon and Washington tanneries, two-thirds are western hemlock. The tanning industry is still in its infancy in these states, and at this writing but few tanneries are in operation. The comparatively small amount of bark used now is but a fraction of the possible output. The industry, therefore, has tremendous possibilities and will undoubtedly become more important as soon as economic conditions adjust themselves to make more profitable the shipping of the extract or the installation of large local tanneries. * * * Although thinner than that of eastern hemlock, the bark of the western species is exceedingly rich in tannic acid. This has long been known to the trade, and several small tanneries now in operation in the Northwest use hemlock bark almost exclusively."

B. L. Grondal, Instructor in Forestry, University of Washington, is quoted as saying: "In the tanneries now operating in the Pacific Northwest, catechu or 'cutch,' tanning extract obtained from the Orient, is used to modify the tanning extract obtained from the western hemlock bark. In this way a very satisfactory and cheap extract can be prepared. Unmodified hemlock bark extract is, however, very satisfactory for many leathers."

At the present time, a large percentage of the lumber exported from western Washington is shipped to countries that are large producers of cattle and other animals whose hides supply the raw material of the tanneries. If a reciprocal trade could be established, the vessels carrying lumber to South America, Mexico, Australia, New Zealand, Africa and Siberia could bring back cargoes of hides at a minimum cost. Last year, more than two million dollars' worth of hides were imported from the Orient, but practically none from any of the other countries came through the Washington ports. In eastern Washington a large number of hides are produced locally and openings for



HANDLING THE "SILVER HORDE."

No. 1. The spillers of a salmon trap. No. 2. 10,000,000 cans of salmon. No. 3. The largest salmon cannery in the world, located at Bellingham.

tanneries are suggested by some of the larger cities in that section.

It seems that this line of business is capable of a wonderful development, both industrially and commercially, as all the necessary material could either be supplied locally or laid down here at a minimum cost. There would be a large local demand for the product as well as an export market in Alaska, British Columbia and trans-Pacific countries, while the surplus could be shipped to Rocky Mountain and Central states by any of the transcontinental railroads or to the Atlantic seaboard by rail, or by steamer through the Panama canal.

The local production of staple and fancy grades of leather would at once open the way for the establishment of large boot and shoe, glove and other leather-working factories for which climatic conditions, abundance of cheap power and excellent transportation facilities render this locality especially favorable.

RUBBER GOODS.

Some of the same conditions which affect the manufacture of leather apply with equal force to the manufacture of rubber goods and point to Washington as an ideal location for great factories to handle this material. Reports to the Department of Commerce for 1916 show that New York was the only customs district in the United States that exceeded Washington in the amount of raw rubber imported, more than twenty-two million dollars' worth having been received in Seattle last year and seven million in Tacoma, largely from the Straits Settlements.

There is no logical reason why much of this raw material should not be manufactured into many articles which are used locally, or exported in large quantities by way of the Pacific Coast ports. Many such articles could be manufactured here as well as on the Atlantic Coast and with a large resultant saving in cost of transportation. These would include especially rubber clothing and footwear for which there is an exceptionally large local demand, owing to the mild, moist winters which prevail near the Pacific Ocean. Then, too, recent manufacturing conditions have caused rubber composition to be used to a large extent in conjunction with, and to replace, leather in some parts of the boot and shoe manufacturing industry.

Another item is automobile tires, there being more than a hundred thousand autos in the State of Washington. Tires for all of these are shipped from eastern factories, involving an expenditure of from five to ten million dollars yearly.

The day should certainly be not far distant when the state will hold the same rank in the manufacture of rubber goods that it does now in the importation of the raw material.

GLASS.

The possibilities for glass manufacture in Washington have been thus far practically overlooked, the only factory in the Northwest being one located in Anacortes, which produces flint-white bottles, jars, etc., of the best commercial quality. Silica sand or glass quartz exists in large quantities in many localities and other factors necessary for glass production can be obtained. Bearing directly on this subject are the remarks of a representative of the Spokane Chamber of Commerce who reports an opening there for a glass factory to make flint glass:

“Silica sand, the chief material, is found here in abundance; freight rates from eastern glass centers are high and act as a tariff protection; cheap gas is a necessary factor, but with our cheapest coals and by the use of mechanical stokers, the problem can be solved; the labor question is important, but by importing a nucleus of skilled help, a good working organization could soon be built up. A large market exists in the Northwest and an export trade could be built up with Australia, New Zealand and China, where German or Austrian goods will probably never be sold again, while the freight rates from New York on American-made goods is prohibitive.”

Reports have been made of silica sand and pure white quartz existing on the Olympic peninsula in the vicinity of Port Angeles. White quartz has also been quarried commercially on Orcas Island and used by the Anacortes plant. Silica of glass making quality is reported to exist in large quantities in the north-eastern part of Yakima county and also in Kittitas and Benton counties. Grant county reports large quantities of silica and soda and a small amount of potash. Lead, arsenic and other minerals used in the manufacture of some forms of glass are also produced in this state.

SUGAR.

Yakima county is about to witness the first extensive, practical test of the possibilities of beet sugar production in the state. A large plant has been erected at Yakima by the Utah-Idaho Sugar Co. and a considerable acreage of sugar beets contracted for in the surrounding country. Laboratory tests indicate that a large portion of Eastern Washington's irrigated section is especially adapted for raising sugar beets and the



Sheep hides at tannery.

practical results of the present operations in the Yakima valley are being awaited by other communities where similar conditions as to soil and climate exist. Arrangements have been practically completed by the same company for the erection in 1918 of a plant at Toppenish.

The Yakima plant is of medium size, having a capacity of about 600 tons in twenty hours, but its equipment is of the best and most modern type. About 7,000 acres of valley land have been planted to beets and it is estimated that from 8 to 25 tons per acre can be produced. For their crop, the farmers receive

\$7.00 per ton and the cost of production is estimated at about \$45.00 per acre. In addition to this guaranteed price, the company offers to divide with them all net profit above \$1.00 per sack. The beets planted are of an early variety and the sugar content runs about 16 or 17 per cent.

The success of this industry will mean much for the state, both industrially and agriculturally, as, next to hops, the sugar beet, according to government reports, has the highest average acre value of any farm crop ever grown in the Northwest, and nearly four times the average acre value of corn or wheat. According to the same authority, the sugar content of beets raised in the Pacific Coast states is higher than in those of any other part of the United States. So, although the industry calls for large capital and technical experience, it has every chance of success when undertaken in the ideal fields of the State of Washington.

POTATO STARCH.

The enormous potato crops in many sections of Washington (there being altogether about 60,000 acres, the average yield of which is 4 to 5 tons per acre) has caused numerous suggestions that starch factories could find profitable openings in a number of communities. The starch manufactured from potatoes is used for laundry purposes, for sizing paper and in textiles, also for other technical purposes as well as in some phases of cookery.

While temporary conditions have caused the market value of potatoes to be out of proportion, they are usually quite reasonable in price and could probably be depended upon to furnish abundant material for several such industries. Generally, the content of starch in Washington potatoes is high and they are well suited for this purpose. The only industrial use that has been made of them in this state has been by a few plants which dried or canned them on a small scale for the Alaska trade.

STRAWBOARD AND PAPER.

Several communities have suggested that openings exist in their vicinity for straw-board and paper factories which might

utilize the straw of the grain growing districts which is now almost entirely wasted. In much of the wheat country east of the mountains, large quantities of straw could be obtained very cheaply, practically all of the cost being that of hauling to the factory. In certain sections of the west side where oats are grown extensively, as in the LaConner flats or in Lewis county, there is an abundance of straw which could be used for this purpose. The present high price of paper and the cheapness of the raw material creates a prospect that seems to merit careful investigation by some manufacturer familiar with this business.

BRIQUETTES.

The large quantities of coal dust and fine coal now practically wasted in many of the mines which are operated in various sections of Washington, afford opportunities for briquetting plants which can utilize this material. By combining the fine coal with a combustible binder, briquettes are produced which form an excellent fuel. Experiments have also been made toward briquetting sawdust and it is probable that, as the cost of fuel advances, it will be possible to produce and market them at a profit.

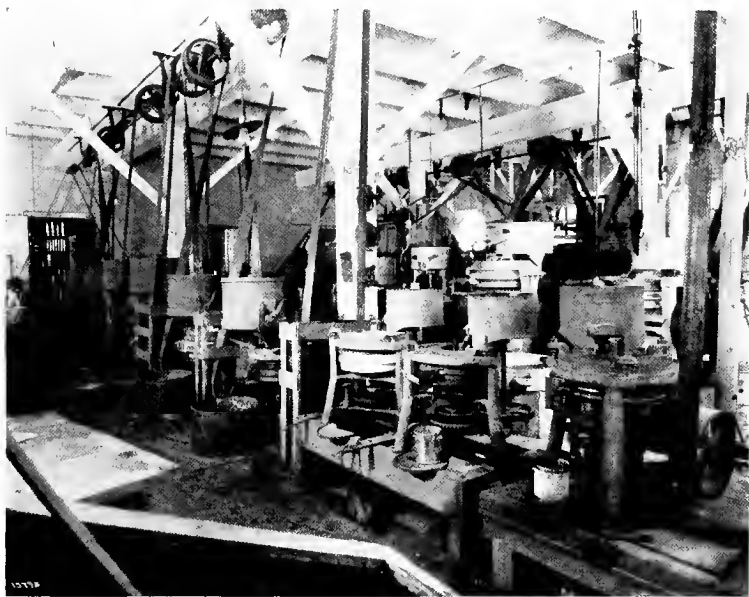
MATTRESSES.

Mattress manufacturing is an industry which does not exist extensively in this state but which might be practical in a number of communities. For cheaper mattresses, excelsior could be produced from varieties of wood which abound in the forests, while cotton from the Orient reaches our ports in large quantities. Wool is extensively raised in eastern Washington and hair could also be procured from that section.

MANY MINOR LINES.

Various parts of the state offer excellent opportunities for other lines of lesser industries which would supply local demands. Among these might be mentioned cigar and tobacco manufacturies, confectionery and candy factories, flavoring extracts and syrup, ice and cold storage plants, foundries and

machine shops, concrete block plants, broom factories, button factories, soap manufacturing and other miscellaneous industries. At the present time, an infinite variety of articles which are used to a greater or less extent by the people of the Northwest are imported from eastern manufacturing centers, but as the local demand grows, it will be found more economical to manufacture such articles in this state.



Interior of paint factory.

CHAPTER XX.

ENCOURAGEMENTS OF A PUBLIC, SEMI-PUBLIC OR PRIVATE NATURE.

Manufacturing in this state holding out such splendid possibilities, the people are doing all that can be expected to encourage those who desire to take up any industrial branch and help develop our latent resources, or utilize raw materials that are at present allowed to go to waste. Although the experiences of many communities have inclined them to discontinue offering special concessions, too liberal franchises or large bonuses, and caused them to investigate, more carefully than hitherto, promotion plans which seem to depend for their success upon large blocks of stock being subscribed locally, yet there are no cities or towns in the state where a worthy enterprise will not find substantial aid and support.

LOCAL ASSISTANCE.

The replies to a questionnaire sent out from this office to the various communities of the state show that out of 275 places reporting openings for one or more industries, 90 made definite offers of special encouragements in the way of free sites, bonuses or other forms of assistance (see table, pages 206-216); while in a number of other instances it was stated that the commercial bodies would carefully consider individual cases and co-operate in every possible way. In several cities, suitable tracts of land have been set aside to be assigned on long time leases, without cost or at a nominal rental, to new industries backed by responsible people. A number of commercial clubs express a willingness to aid desirable enterprises and *bona fide* propositions in securing additional capital by local subscription, and committees of their business men stand ready to assist in this way. Valuable information regarding the supply of raw material, markets, transportation, etc., can also be obtained from such organizations by the manufacturer seeking a location for his industry.

Another substantial service which many local commercial bodies will render, applies to such industries requiring the development of certain resources in the community. For example,

the successful operation of a condensery depends upon the available supply of milk; a cannery must have a definite quantity of certain fruits and vegetables; while a beet sugar factory must be guaranteed a sufficient acreage of beets. The business men through their commercial organizations in communities which present favorable fields for such industries will assist actively in securing the co-operation of farmers and dairymen and other producers and in arranging for an adequate supply of all materials when a reasonable profit can be promised.

In many localities, manufacturers of special lines will be assured substantial co-operation from private individuals or companies operating allied industries. For instance, factories that can utilize waste or short length lumber will be given every reasonable assistance by many of the saw mills, and coal mine operators would co-operate with plants which could briquet the fine coal or extract chemical by-products.

FEDERAL AIDS.

The state and federal governments, through their various departments and commissions, also render valuable assistance to those in a position to take advantage of it.

Some of the principal encouragements by the federal government occur in connection with the administration of the national forests. They include the sale of timber, the issuance of stock grazing permits, the granting of mining privileges and opportunities for water-power development. Regarding such work, the district forester says:

"The government offers for sale, on application, tracts of 'stumpage' which is ripe for cutting, the timber to be cut under regulations which provide for the perpetuation of the forest and the growing a second crop. The price charged for stumpage in commercial sales of national forest timber is the appraised value of the timber, which varies with species, accessibility, quality, etc.

"Stock grazing privileges upon the national forests are permitted by the forest service and a graduated scale of fees is charged per season, based upon the yearlong rate of 75 to 80 cents per head of cattle, 94 cents to \$1 per head for horses, 52½ cents per head for swine, and 18 to 20 cents per head for sheep.

"Embracing, as they do, the headwaters of practically all the important streams of the state, the national forests offer special opportunities for water power development. The title to these power sites is never transferred outright to individuals or corporations, but development and utilization privileges are granted. The annual charges for these privileges are based upon the net electrical horse power capacity of each project, and range from 10 cents per horse power for the first year, to \$1 for the tenth year; continuing at the dollar rate each succeeding year for each net electrical horse power, for a term of not more than fifty years, with privilege of renewal at the expiration of the period covered by the permit.

"Through government and state co-operation and the rigid enforcement of protective laws, and a systematic and effective organization of forest patrol, the danger from fires has been materially reduced and all public interests within the national forests carefully conserved.

"Miners and prospectors have the same privileges upon the national forests as elsewhere upon the public domain. Mining claims may be located and the timber necessary for their development may be cut on the claims. Miners and prospectors may also obtain free permits to cut timber from national forest land outside the limits of their claims when needed for developing their prospects."

The federal government has been instrumental, through other departments, in providing much accurate information about the geological and meteorological conditions existing in this state. Surveys of soils, power sources and reports on mineral resources of the state, prepared by federal geologists in co-operation with the state department of geology, are available for the information of those interested; and the weather bureau stations in various localities have kept records of climatic conditions which would prove valuable to many lines of industries.

STATE AIDS.

One of the principal ways in which the state government encourages manufacturing is by the selling or leasing, under liberal terms, of its public lands, which include many miles of tide and shore lands well suited for manufacturing sites. Such lands may be purchased at public auction by the highest bidder, but at not less than the appraised valuation, which is usually comparatively low; and may be paid for either in cash or on terms



Big brick and lime factory near Spokane. There are unlimited clay deposits of all kinds in Washington, and in almost every county. Limestone is common in many sections.

of 10 per cent. cash, and the remainder in nine equal annual installments, with interest at 6 per cent. on deferred payments. Much leniency is shown by the state in the carrying out of such contract. Should temporary financial stringency overtake the purchaser and make it impossible for him to meet the exact requirements of the obligation, it is the policy of the land department to take no advantage of the situation, but to allow the purchaser every reasonable opportunity to show good faith in his efforts.

Under the constitution of Washington, "the use of the waters of the state for irrigation, mining and manufacturing purposes shall be deemed a public use." For the purpose of permitting power development or the storage of water for manufacturing, the state grants the right to overflow its lands adjoining lakes or streams; and permits for this can be secured directly from the State Board of Land Commissioners, subject to payment of damages incurred, without the necessity of purchasing the land, thus eliminating the uncertainty of securing it at public auction.

Under the provisions of the new Water Code, adopted in 1917, persons or corporations desiring to appropriate water from streams or store water for a beneficial purpose, may secure permits from the State Hydraulic Engineer after proper investigation. To safeguard every legitimate effort and stimulate the development of the water resources of the state, a temporary permit will be issued, which prevents interference and protects the applicant's priority. This will be continued under certain regulations until the issuance of the regular permit or until sufficient reason is found to reject the application.

The state will also sell timber from its lands and lease the right to mine all minerals, oil and gas, with the exception of coal. Complete information regarding state lands and the regulations governing them can be obtained from the Commissioner of Public Lands, Olympia.

Something of the magnitude of the wealth at the disposal of the state may be understood from the fact that the public domain placed under the control of the state land office contains 2,701,990 acres of uplands and more than 1,800 miles of tide

and shore lands. This area is equal to more than two and a fifth times the state of Delaware, while its length of water front exceeds the sailing distance from New York to Galveston.

INDUSTRIAL LEGISLATION.

Washington has been one of the foremost states in the adoption of legislation for the wise regulation of labor conditions and the protection of working men and women, but experience has shown that, in the enactment of these laws, the best interests of the employer have been considered and that their application has generally been beneficial to the growth and prosperity of existing industries. Among the measures of legislation which apply in some degree to manufacturing industries are the Industrial Insurance and First Aid acts, the Eight Hour Law for Women, the Minimum Wage Law, and laws regulating child labor; also those regulating public utilities through the Public Service Commission.

The Industrial Insurance law, which was originally passed in 1911 and has since undergone a few modifications, guarantees compensation to injured workmen or their dependents through a fund collected from the various classes of industries providing hazardous employment, this fund to be collected and administered by a commission of three men known as the Industrial Insurance Commission. The effect of this act is to abolish all civil action for personal injury by the employee against the employer, to remove any necessity for the intervention of casualty companies, and to relieve the individual employer from direct liability. This law is based on the theory that the cost of accidents occurring in any industry should become a part of the cost of the product, so that the expense may be borne by the ultimate consumer rather than that either the individual or the employer should bear the entire burden of the inevitable hazard of production. As a supplement to this law, the legislature of 1917 added a provision for "first aid" and medical attendance to be paid out of a fund to which both workmen and employers contribute, and to be similarly administered.

To protect women and the homes, a law was passed providing that no female should be employed in any mechanical or mer-

cantile establishment, laundry, hotel or restaurant in this state more than eight hours during any day except when employed in harvesting, packing or canning any variety of perishable fruit or vegetable, or canning fish or shell fish. This law also requires suitable seats to be provided for the use of women when not actively engaged in their duties.

The Minimum Wages for Women law, passed in 1913, recites that "the welfare of the state demands that women and minors be protected from conditions of labor which have a pernicious effect on their health and morals," and declares that inadequate wages and unsanitary conditions of labor exert such pernicious effect. It provided for the creation of the Industrial Welfare Commission to establish such standards of wages and conditions of labor for women and minors employed within the state as should be held to be reasonable and not detrimental to health and morals and which should be sufficient for the decent maintenance of women. The commission was established and the act put into effect with very beneficial results for employee and employer.

Since 1911, the power to regulate common carriers and public service corporations in this state has been vested in the Public Service Commission. This commission has supervision over railroads, steamboat lines, street and interurban railways, light and water companies, telephone and telegraph lines and public wharves and warehouses. It establishes and enforces uniform rates and service, and guards against discrimination or unfair methods of competition.

The manufacture and sale of intoxicating liquor has been prohibited in Washington since the beginning of 1916, thus eliminating some lines of industrial enterprise and opening additional fields for new ones. Since this law went into effect, a number of the breweries have been converted into plants for the manufacture of other products, particularly non-intoxicating drinks made from malt or fruit juices. The adoption of prohibition has also had a beneficial effect on social conditions, particularly among the industrial workers.

Other legislation and state supervision of interest to the manufacturer includes laws which provide for the proper safe-

guarding of machinery, sanitation in factories and workshops, a state inspection of weights and measures, and the inspection of many classes of material, such as agricultural, horticultural and dairy products, coal mine inspection, etc.

RESEARCH ASSISTANCE.

The University of Washington at Seattle, and the State College at Pullman also render important assistance to industrial plants. These institutions are well equipped with laboratories and special apparatus for making tests and exhaustive studies of materials and processes. Their services and facilities are always available to persons needing them.

In the University of Washington, "a special bureau of industrial research is maintained for the purpose of co-operating with the industries of the state in the study of industrial problems. Such problems may be referred to the University as industrial fellowships and through this bureau, the various departments of the University co-operate in the study of a given problem." In this way, "the industries of the state benefit through the research work done at the University and the special training given to men who become interested in the particular problems of any industry." For the year 1917-18 three fellowships have been established, one problem dealing with the iron and steel industry, another with a study of wood preservation while a third is making an industrial survey of Seattle and its environs. In this connection the reader is also referred to chapter XVII of this publication.

Among the departments of the University which are equipped to render special service along industrial lines are the botany and chemistry laboratories; the civil engineering laboratories, with special departments for experiment in hydraulics, structural materials, cement and road material testing; electrical engineering laboratories; forest laboratories, with special equipment for studies in timber physics, wood technology and utilization of forest products, including a general laboratory and special departments for research in wood preservation, wood distillation and kiln drying; mechanical engineering laboratories, in connection with which are thoroughly modern woodworking

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OMAHA, NEB., June 2, 1910.

Mr. W. C. Jarron,
Pullman, Washington.

Dear Sir:

We are pleased to be able to notify you that you won first
on Prem. 207, Milling Oats. The premium is the Johnson Grain
Binder, value \$150, offered by Johnson Harvester Company,
Batavia, N. Y.

Their jobbers are Lininger Implement Company, Omaha, Neb.,
who I think will handle the binder in sending out the binder.
Will you send the enclosed certificate of award to the
Lininger Implement Company, with instructions as to shipping the
premium.

Very sincerely yours,

T. F. Sturges
Secretary.

THIRD ANNUAL EXPOSITION - DECEMBER 6 TO 18, 1909



Certificate and medal proving the high quality of Washington grain.

shops, machine shops, foundry and forge shop; pharmacy and materia medica laboratories for research in drug analysis and manufacturing pharmacy; and geology and mining and metallurgical laboratories. These latter in addition to their own very complete equipment are supplemented by that of the U. S. Bureau of Mines Experiment Station, which is conducted in connection with the College of Mines. This is more fully discussed in last part of chapter XVII, to which the reader is referred.

The State College, also, is equipped with a number of excellent laboratories, including a very complete one for testing materials, and special laboratories for agronomy, dairy products, animal husbandry, poultry and farm mechanics. It maintains as well a number of experiment stations at various points in the state where special work is done along lines of agriculture and horticulture and their branches, with special regard to peculiar local conditions.

The instructors and advanced students at these institutions are generous with their time, and spare no efforts to render every possible aid in the investigation of problems that confront the manufacturer.

LOCAL PRIDE.

The citizens of Washington are proud of their state and proud of the rapid development already made. They stand ready to lend loyal support and patronage to industrial institutions located in their midst. This feeling accounts for the existence of a number of organizations in different cities which have for their main purpose the cultivation of a kindly spirit toward all Washington-made goods. Each of the largest cities have manufacturers' associations which make a point of exhibiting and advertising such articles, while home consumers' leagues and other allied organizations are becoming more active in urging local use of all "Made in Washington" products.

So, with loyal support and general encouragement from the home people, an infant industry is given every chance of reaching maturity and extending its usefulness to the rest of the world.

CHAPTER XXI.

INDUSTRIAL CENTERS OF THE STATE.

While a large portion of the State of Washington is well adapted for general manufacturing and there are few sections where some special lines would not prosper, there are certain centers of population which, because of a combination of natural and artificial advantages, have already attained considerable importance and offer particular promise of further industrial growth. Although it is impossible, in the limited space afforded, to give more than a brief outline of their scope and development, this publication would be incomplete without some individual mention of these principal cities, both because of what they have become and promise, and because general conditions in each of them to a certain extent reflect the conditions in their immediate vicinity. These centers exercise a direct influence on agricultural and industrial conditions throughout all the territory tributary to them, and their accumulated development largely constitutes the development of the state.

The State of Washington contains one city of more than 300,000 population, two others of more than 100,000 population, two of about 35,000, two of more than 20,000, and four of 10,000 or over, all of which have achieved more or less importance as manufacturing centers. There are also a number of smaller cities which, by reason of location or some particular advantage, have become trade centers for a considerable territory and which have already made extensive industrial progress or offer exceptional opportunities for some line of manufacturing.

With few exceptions the cities of Washington are of modern construction. They are equipped with ample water supply (usually municipally owned), electric lights and power, gas connection and sewers. Careful attention is given to sanitary conditions, and the larger cities have spent much money in beautifying by means of spacious parks, scenic drives and broad boulevards.

wards. A high school education is assured in every town. Telephone, telegraph and express service are almost universal.

The paragraphs below are devoted to the brief description of a few of these cities, and the others are mentioned in the second table which follows, containing tabulated information relating to all communities requesting additional plants and concerning which it was possible to secure authentic data. Nearly all maintain local commercial organizations from which additional information can be obtained.

SEATTLE, estimated population 366,445, is the county seat of King County and the metropolis of the state. It is located on Elliott Bay, an indentation of Puget Sound, and occupies the hills and valleys lying between the salt water and Lake Washington. The city covers 60,460.8 acres and the distance from its northern to southern boundaries is about twelve miles. Green Lake and Lake Union lie entirely within the city limits. A ship canal recently completed by the United States government connects Lake Washington through Lake Union with the Sound. This canal cost \$3,625,000 and its locks are the largest in this country excepting those of the Panama Canal. It gives ocean vessels access to a vast fresh water harbor and adds more than a hundred miles of shore line to an already extensive deep-water frontage. Because this additional waterfront is not subject to tidal conditions, it will be especially valuable as sites for industrial plants.

At present, the city's wharves and docks number 29, with a lineal frontage of 13 miles; their combined landside and shipside spur track capacity is 1,600 cars; wharf space, 3,500,000 square feet; and merchandise storage capacity, 900,000 tons. A hundred vessels can be simultaneously accommodated. There are also six drydocks with a combined lifting capacity of 50,000 tons.

Three systems of electric railway with a total mileage of 252.53 miles operate within the city, and interurban electrics connect with Tacoma, Everett, and Renton. Seven transcontinental and one intrastate railway enter. Service is given by 14 foreign, 15 coastwise, 19 local, and 4 city steamship companies. It has 264 miles of paved streets, 1,730 miles of graded streets, and 836 miles of concrete walks.

In 1914 there were 1,014 factories, the value of manufactures being about \$65,000,000. The most important of these, commercially, included 55 lumber and timber products plants, 24 furniture factories, 82 foundries and machine shops, 214 printing and publishing houses, 5 brick and tile yards, 3 slaughtering and meat packing plants, 10 flour mills and grist mills, 10 canning and preserving plants, 4 butter factories, 15 other food factories, 45 copper, tin and sheet iron works, 5 malted liquor establishments, 5 men's clothing factories, 34 confectioneries, and 10 leather goods factories. Extensive developments of the past year would raise these figures ma-

terially. Among the newest developments is the steel and wooden shipbuilding industry which employed 2,000 men in September, 1916, and 12,000 men September 1, 1917. Four months later, there were nearly twenty thousand men employed. Some of the largest lumber and fishing industries of the state are centered here and the most important coal fields of the state are tributary. Both water and electric power, municipally owned, are available at low rates.

In 1916, its assessed valuation was \$213,273,327; postoffice receipts, \$1,563,397.83; and bank clearings, \$790,217,950.01. It boasts the highest building west of New York. It has six high schools and sixty-nine graded schools, and is the seat of the University of Washington. Several business colleges and private schools are also located here.

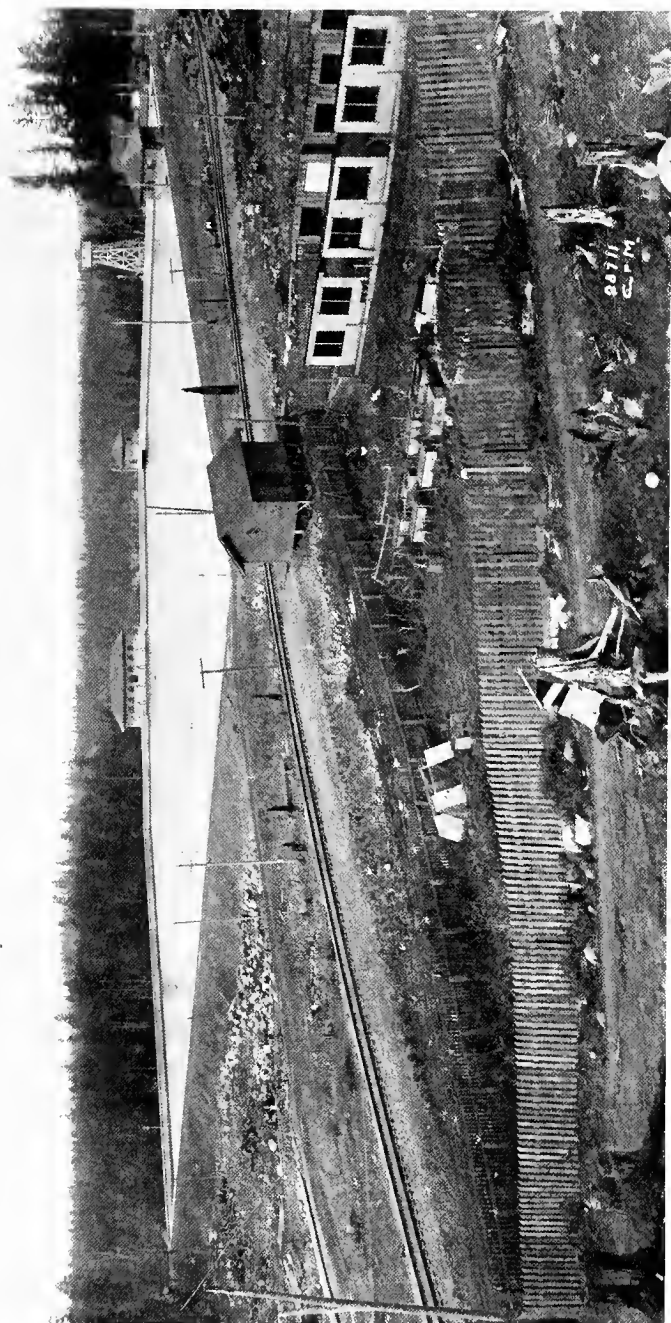
Opportunities for the establishment of almost any kind of new industry exist. The Industrial Bureau of the Chamber of Commerce has arranged for the utilization of certain factory sites owned by the county at a very moderate figure and with no taxes on the land, by industries whose chances for success are favorable. Free sites may be obtained in some cases from private firms and other organizations having large holdings on Lake Washington or on Puget Sound, a short distance outside the city limits.

SPOKANE, Washington's second city in size (estimated population, 130,000), is the county seat of Spokane County and the financial, commercial and industrial center of the district known as the "Inland Empire." This tributary territory, which includes much of Eastern Oregon and Washington, Northern Idaho, Western Montana and Southeastern British Columbia, has remarkable resources in agriculture, mining and timber, and abundant water power; its estimated annual production of new wealth is \$350,000,000.

The city itself occupies 25,120 acres lying on either side of the Spokane River, the wonderful falls of which are in the heart of the business district and furnish the power for many of its industries. Four power plants supply 172,000 horsepower. The river descends 1,280 feet in a distance of 100 miles, making possible a development of 400,000 horsepower, while the estimated potential power of the entire Inland Empire is 3,000,000 horsepower.

Spokane is a great railway center. Seven transcontinental lines enter, besides a number of local and branch lines. It has 150 miles of street railway and is connected by 213 miles of electric with the principal surrounding cities. It has 72 miles of paved streets, 393 miles of graded streets and 634 miles of concrete sidewalks. The concrete approaches by which some of its railroads reach the central station are feats of modern engineering.

The most important raw materials available are minerals, cereals, timber, fruits, livestock, pulp-wood, clay, cement-rock and wool. The adjacent mining region is estimated to produce one-third of the entire lead output of the world; while mines, the activities of which center in Spokane, paid \$12,000,000 in dividends in 1916. One-ninth of the entire wheat crop of the United States is



Nisqually power plant reservoir at La Grande, from which Tacoma derives power and light.

produced by this tributary section, which also has a national reputation for its fruits.

Such favorable conditions have caused Spokane to make great progress as a manufacturing city. The value of its manufactures in 1914 was close to \$17,000,000. Included among its industries were 20 relating to lumber and timber, 23 foundry and machine shops, 56 printing and publishing plants, 22 bakeries, 3 flour mills and grist mills, 16 copper, tin and sheet iron plants, a large paper mill, cement plant, packing establishment and brick yard. Recent development has been proportionate to other sections. Estimates by the Chamber of Commerce place the value of manufactures for 1916 at \$25,000,000.

Additional statistics include: Building permits (1916), \$1,576,737; total assessed valuation, \$80,217,218; actual valuation, \$160,434,686; banks, 14; clearings (1916), \$255,205,283; post-office receipts, \$344,686; public schools, 37, with 20,018 pupils enrolled; wholesale business, yearly value, \$30,000,000.

Special openings are reported by the industrial bureau of the Chamber of Commerce for a shoe factory, flint glass works, pottery factory, for pottery and insulators, and trunk factory. Opportunities also exist for many other miscellaneous lines of endeavor.

TACOMA, estimated population 120,000, is the county seat of Pierce County and the second city in size in Western Washington. It occupies a commanding eminence overlooking Commencement Bay on Puget Sound. Its total area comprises 25,168 acres of land and 2,752 acres of water. The distance from its northern to its southern boundary is about seven miles. It possesses extensive tide flats where space for innumerable factories and shops are available. Altogether at least 1,500 acres are suitable for such purposes.

At present the city's wharves and docks number 35, with a lineal frontage of approximately two miles. Their combined land-side spur track capacity is 700 cars; wharf space approximately 950,000 sq. ft. and merchandise storage capacity 170,000 tons. Fifty vessels can be simultaneously accommodated. There is also one drydock with a lifting capacity of 12,000 tons.

Tacoma has a total of 147 miles of electric railway and is connected with Seattle, Puyallup and American Lake by suburban electrics. Its railway service is about the same as Seattle's. In addition, service is rendered by six foreign, four coastwise and eight local steamship companies. It has 123 miles of paved streets, 319 miles graded and 400 miles of cement sidewalks.

In 1914 there were 339 factories and the value of manufactured products was \$12,600,000. These plants included 26 lumber and timber product factories, 10 furniture factories, 27 foundries and machine shops, 18 copper, tin and sheet iron works, 15 cigar factories, 36 bakeries, 7 flour and grist mills, 58 printing and publishing establishments, besides many other miscellaneous industries. The extensive developments of the past year or two would increase these figures materially. This, too, is an important shipbuilding

point and many large steel and wooden ships have been recently contracted for. On September 1, 1916, there were less than 100 men employed in Tacoma's shipyards. At a corresponding date in 1917 approximately 3,500 men were working in them and by January 1, 1918, the number had reached 4,000 and more were being added each day. Large lumber and fishing industries are centered here and important coal fields are tributary. Of extreme importance is the big smelter, the second largest in the United States, which employs 1,100 men and has an annual output of \$40,000,000. Water and electric power, municipally owned, are available at low rates.

In 1916 its assessed valuation was \$54,629,845; postoffice receipts were \$295,985.48; bank clearings, \$790,217,950.01; and building permits, \$1,617,981.00. It has a Greek stadium seating 30,000 people, which probably has no duplicate in the world. Its 32 school buildings, which include 3 high schools, contain 13,440 pupils, giving employment to 430 teachers. Several private schools are also located here.

Opportunities for additional industries in nearly all lines are numerous. For local markets nearly all Southwestern Washington is tributary. Of special importance is the United States army post at Camp Lewis, 17 miles south, where nearly 50,000 men are now in training and where at least one army division (18,000 men) will be garrisoned in times of peace.

EVERETT, estimated population 36,000, is the county seat of Snohomish County and the principal trading point for Snohomish and Island counties and adjacent territory. Its area is 6,400 acres. Situated on the peninsula between the mouth of the Snohomish River and Puget Sound, it has the advantages of 22 miles of deep water frontage; the largest ocean steamers can reach its docks. It is the port of call for steamers of the regular Pacific Coast and Alaska lines. Five regular steamers connect with Seattle and one runs daily to Bellingham. Four transcontinental railroads and two electrics to Seattle, Snohomish and Monroe, furnish rail transportation. It also has 17½ miles of local street railway, 7 miles of paved streets, 40 miles graded, and 101.7 miles of concrete walk.

The city's assessed valuation is \$13,894,893; postoffice receipts (1916), \$79,200; public schools, 13, with 174 teachers and 5,316 pupils. A separate vocational school and several private schools are maintained.

The principal raw materials are timber, fish, clay and cement materials; also dairy and other agricultural products. Manufacturing statistics according to the 1914 census show 98 industrial plants, capitalized at \$6,297,833, employing 2,112 men, and turning out products valued at \$6,530,405. Recent estimates by the Commercial Club place the yearly production at \$15,000,000 and the number of men employed at 4,496. Thirty-one of these plants utilize timber products and range from large sawmills, cutting 750,000 feet of lumber per day, to box factories and cabinet works. Included in these are ten straight shingle mills, six straight lumber and seven

combination lumber and shingle mills; also a large pulp and paper mill, five iron works, three fish canneries, a flour mill, and tannery.

Openings are reported for a furniture factory and for shipyards.

BELLINGHAM, with an area of 10,000 acres and an estimated population of 35,000, is the county seat of Whatcom County and the metropolis and chief trading center for Whatcom, Skagit and San Juan counties. Its harbor, Bellingham Bay, can accommodate steamers drawing 26 feet of water. Regular steamers run to Seattle and way points; also out among the islands. It is served by three transcontinental railroads, 33 miles of interurban electrics and 25.5 miles of street railway. Paved streets total 40.7 miles and concrete walks 93.6 miles.

Further statistics show, assessed valuation, \$10,742,396; actual valuation, \$32,000,000; 4 banks, clearings (1916), \$30,000,000;



Glass factory at Anacortes. The only one in the Northwest.

postoffice receipts (1916), \$74,154.73; 13 public schools, 5,207 pupils; state normal school, enrollment, 200.

Its greatest activities are directed towards timber products and fisheries, but the surrounding country is also important for dairying and other agricultural pursuits. Some mining is also carried on. In 1914, according to the United States census, there were 86 plants with an output for the year of \$6,264,000. A rapid increase, however, is now taking place. Among the most important establishments today are 11 lumber and shingle mills, employing about 1,700 men, representing a capitalization of \$3,500,000, two shipyards, eight fish canneries, including the largest salmon cannery in the world, nine woodworking industries, three creameries, three iron works, one of the most modern cement plants in the United States, brick yards, flour mill and a number of miscellaneous plants.

Openings are reported for paper mills, tile, brick and pottery factories, furniture factory and a broom and broom-handle factory. Three hundred acres of land suitable for factory sites are available.

PORT ANGELES, population 5,000, is the county seat of Clallam County and the most westerly city on Washington's great inland

sea. It is the commercial and industrial center of the northwestern part of the Olympic Peninsula, a territory possessing enormous resources of timber and fishing, with indications of abundant minerals and promise of greatly increased agricultural production. Four steamboats make daily calls. Rail connection with Port Townsend is supplied by a branch of the Milwaukee, which connects at Port Townsend with special steamers to Seattle. Power is provided by the Olympic Power Company's hydro-electric plant on the Elwah River, which also serves Port Townsend, Bremerton and the Puget Sound Navy Yard, and is capable of very large development.

It has at present six shingle mills, three sawmills, box factory, cement block and tile factory, furniture factory, brick yard, salmon cannery and two octopus fishing plants. Opportunities are reported for a paper and pulp mill, flour and feed mill, oatmeal factory, shingle mill, lumber mill, veneer mill, barrel and tub factory, broom and tool factory, furniture factory, fertilizer and potash plant utilizing kelp, tannery and tannic acid factory, brick and tile factory, and glass works. Special inducements in the way of suitable sites are offered.

PORT TOWNSEND, population 5,000, is the county seat of Jefferson County and commercial center for the northeastern section of the Olympic Peninsula. It is a port of entry and a station for United States immigration, quarantine and revenue cutter service. It also has a United States custom house and is close to three federal forts, Casey, Flagler and Worden, which guard the entrance to Puget Sound. A recently completed canal gives an inside passage from its excellent harbor to the main Sound, which enables small craft to avoid the heavy seas of the Straits and shortens the distance to up-Sound points. It is served by several steamers and has rail connection with Quilcene and Port Angeles.

The resources of the tributary territory include timber, fish, dairy and agricultural products, also abundant mineral deposits. Its principal industries consist of two salmon canneries, fertilizer plant, sawmill, woodworking plants and boat shops. Openings are reported for sawmills, shingle mills and shipyards.

ANACORTES, estimated population 5,000, is located on deep water at the western extremity of Skagit County, of which it is the metropolis. It has extensive wharfage and is served by both ocean vessels and Sound steamers. Rail service is rendered by the Great Northern. It has $2\frac{1}{2}$ miles of paved streets, 25 miles of graded streets and 16 miles of concrete walks; 6 public schools, 36 teachers and 1,070 pupils. Its assessed valuation is \$1,262,000.

Present industries include 7 shingle mills, 8 salmon canneries, 4 codfish plants, 2 mild cure plants, 3 lumber mills and box factories, 2 glue, fish oil and fertilizer plants, 1 glass factory, 2 creamery and cold storage plants, and a large shipbuilding plant. Factory sites are plentiful. Openings are reported for furniture factory, strawboard factory, cereal mill, shipbuilding plant with ways for purse seine boats, and foundry and machine shop.

SKAGIT VALLEY CITIES: The industrial and commercial activities of this valley largely center in a number of small cities, the largest of which are Mount Vernon, Sedro Woolley and Burlington, linked together by interurban electrics running out of Bellingham. The resources are chiefly timber and agricultural, this being one of the rich farming districts of the state. Mineral resources, including coal and limestone and iron, are found in adjacent mountains.

Mount Vernon, population 3,500, is the county seat and one of the most important dairy centers of the state. It is located on the Skagit River, which is navigable to this point, and the main line of the Great Northern. Two large condenseries and a creamery are located here; also several lumber mills, woodworking plants and a machine shop. Opportunity for a cannery is reported.

Sedro Woolley, population 3,000, is eight miles northeast of Mount Vernon on the Great Northern and Northern Pacific railroads. This city has developed rapidly as a manufacturing center, and has several saw and shingle mills, a large foundry and machine shop, veneer and excelsior plant, ice and cold storage plant, bottling works, creamery and condensery. Additional industries will find good opportunities and local encouragement.

SNOHOMISH, population 5,300, is located on the Great Northern, Northern Pacific and Chicago, Milwaukee & St. Paul railways; 10 miles southeast of Everett. The navigable Snohomish river runs through the city and provides considerable manufacturing area with deep-water advantages. An electric road connects with Everett and Seattle. It has several shingle, saw and planing mills; condensery and creamery, cannery, iron works and brick-yard. Openings are reported for a paper mill, ship yard and rubber goods factory.

BREMERTON, estimated population 6,000, is the metropolis of Kitsap County. It is situated on Port Orchard Bay, an arm of Puget Sound, 16 miles west of Seattle, with which city it is connected by hourly steamers. Its principal industry is the Puget Sound Navy Yard, where the federal government constructs and repairs naval vessels. More than 2,000 mechanics and laborers are employed during normal times by this plant, which represents an investment in excess of \$12,000,000. The city is growing rapidly as the result of increased federal activity.

Its excellent harbor and proximity to Seattle are important advantages for general industries. Opportunities exist for the establishment of private shipbuilding yards and other industries which would require skilled labor of a class used in the yard and which could cooperate with the government in providing these men with continuous employment.

RENTON, estimated population 5,000, is located near the southern end of Lake Washington, four miles from the southern limits of Seattle, with which city it is connected by two electrics. Service is rendered by the Northern Pacific, Chicago, Milwaukee & St. Paul

and Columbia & Puget Sound railroads. The recent opening of the Lake Washington canal is expected to result in much development around this city, for considerable lake waterfront, well suited for manufacturing sites, is adjacent. Extensive coal mines are near and the largest units of the Denny-Renton Clay and Coal Company are located here. Other industries include a car manufacturing plant, briquetting plant and a macaroni factory. Openings are reported for a furniture factory, paper mill, creamery and cannery.

PUYALLUP, population 6,000, is the second city in size in Pierce County and the commercial center of the Puyallup Valley.



Manufacturing orchard spray at Wenatchee.

a district famous for fruit and berry growing. Being but nine miles from Tacoma, many of the same general conditions prevail. It is served by the Northern Pacific and Chicago, Milwaukee & St. Paul railroads and an electric road to Tacoma, and makes connection with the Seattle-Tacoma electric railway.

The principal industries relate to the preserving and canning of the fruits, berries and vegetables grown in the surrounding country. The production and marketing of these crops has been highly systematized through the medium of a local fruit growers' association. Several box factories and sawmills, a shingle mill and creamery are located here. Openings are reported for a cigar factory and bottling works.

OLYMPIA, population 12,000, is the state capital, county seat of Thurston County and the center of a large agricultural and tim-

ber area. Commercial building stone, coal and other minerals are adjacent. Located on a deep water harbor at the extreme southern end of Puget Sound, it is served by several lines of steamers. Rail transportation is provided by the Northern Pacific and Oregon-Washington Railroad & Navigation Company. Hourly stages run to Tacoma and several to Shelton, Tenino and Grays Harbor. It has also six miles of electric railroad which extends to Tumwater, the oldest town on Puget Sound. One of the largest of the sixteen United States cantonments is located 17 miles northeast.

Within the past year Olympia has become one of the important wooden shipbuilding points of the state, having two large yards, one with three and the other with eight ways, actively engaged in constructing great ocean-going cargo vessels. It is the largest shipping point in the state for oysters, both native and transplanted. Other industries in operation are three lumber and two shingle mills, sash and door factory, feed mill, fruit cannery, two iron works, knitting mill, two creameries, and an extract factory.

Openings are reported for a brick yard, broom factory, cooperage plant, cheese factory, flour mill, furniture factory, paper mill and pottery plant. Manufacturing area is extensive.

ABERDEEN AND HOQUIAM: The commercial, financial and industrial activities of the Grays Harbor country center in the cities of Aberdeen and Hoquiam, which occupy closely adjoining locations on the deep water harbor at the mouth of the Chehalis River. The district largely tributary to these cities embraces the southern part of the Olympic Peninsula and the lower Chehalis Valley. The chief resources of this territory are timber, including large bodies of spruce suited for aeroplanes, fish, crabs, clams and whales, and agricultural and dairy products. It is one of the most important lumber manufacturing sections of the state. Ocean vessels ply between these ports and every land, while packet steamer lines connect them with California ports. Railway service is supplied by three transcontinental systems, The Northern Pacific, Chicago, Milwaukee & St. Paul, and Oregon-Washington Railroad & Navigation Company. An interurban electric connects the two cities.

Aberdeen, population 18,000, has an area of 6,720 acres; assessed valuation, \$7,415,979; actual valuation, \$14,831,598; 26.62 miles of paved streets; 24.4 miles of graded streets; 27.1 miles of concrete walks; 11 public schools, 73 teachers, 2,110 pupils. Post-office receipts in 1916 were \$37,702.70. Besides numerous smaller plants there are twenty-three factories located here, which, according to a present estimate by the Chamber of Commerce, are valued at \$15,000,000 and produce \$14,000,000 in manufactures annually. They include 3 big shipyards, 1 spar yard, 13 timber and shingle mills, 1 wood tub and bucket plant, and 4 salmon and clam canneries. Three hundred and thirty acres of land of patent value for manufacturing sites is available. An excellent opening is reported for a pulp and paper mill.

Hoquiam, population 13,000, has an assessed valuation of \$3.-873,415 and an actual valuation of \$7,746,830; 6 miles of paved streets, 21 miles of graveled or planked streets, 9 miles of concrete walks; 6 public schools with 50 teachers and 1,800 pupils. Post-office receipts in 1916 were \$25,490. Its Chamber of Commerce reports 40 manufacturing plants, all told, with lumber exports alone for 1916 of over \$11,000,000. Nine sawmills, 6 shingle mills, 2 large shipyards and 2 fish canneries are among the most important establishments. Factory sites are plentiful and may be secured free or at moderate cost. Openings are reported for cooperage and other lumber products plants, shipbuilding, woolen mills and iron and steel plants.

SOUTH BEND AND RAYMOND: These two neighboring cities, located on Willapa Harbor and connected by a local trolley line, are the commercial and industrial centers for Pacific County in the southeastern corner of the state. Resources, transportation facilities, and future possibilities are similar. A heavy timber growth, fertile lands, and extensive salmon and shell fisheries supply abundant raw materials; while numerous streams on the slopes of the coast range create vast potential water power. Big ocean-going vessels load at these ports and coasting vessels ply between them and California. Local steamers connect at Nahcotta with Oregon-Washington Railroad & Navigation Company trains for Ilwaco and Astoria, Oregon. The Northern Pacific connecting at Chehalis renders rail service for both cities. The Chicago, Milwaukee & St. Paul reaches Raymond. Extensive deep-water manufacturing sites are available in both cities.

South Bend, population 3,000, is the county seat. Its assessed valuation is \$1,385,903.00. Bank clearings in 1916 were \$8,000,000 and postoffice receipts, \$9,022.00. Its industries include several sawmills and shingle mills, fish canneries, three oyster plants, furniture and cabinet works, and box factory. Openings are reported for shipyards and wooden toy factory.

Raymond, population 5,000, was built up almost entirely from the lumber industry. Its assessed valuation is \$1,774,864; bank clearings (1916) \$7,950; and postoffice receipts (1917) \$13,472.26. Ten big cargo ships are at present being constructed. Other sustaining industries include 7 saw mills, 5 shingle mills, 2 veneer plants and 2 box factories. Openings exist for additional ship yards, two excellent sites being available.

CENTRALIA AND CHEHALIS: The central inland portion of Southwestern Washington, a region of fertile valley, with a wealth of coal, timber and agricultural products, has for its principal centers of population the cities of Centralia and Chehalis, about four miles apart and connected by electric railway and four transcontinental lines besides two Willapa Harbor branches. Connections are made at Centralia for Grays Harbor points. Lewis County, in which these cities are located, has a larger area of agricultural land

than any other county in Western Washington. Both cities have electric power from a transmission system passing through them, and cheap fuel is supplied by coal mines in the immediate vicinity. Each has ample area for sites which can be secured on attractive terms.

Centralia, population 11,000, has an area of 2,300 acres, an assessed valuation of \$2,442,910; 5 $\frac{1}{4}$ miles of paved streets, 30 miles of graded streets, 54 miles of concrete walks, 5 public schools, 39 teachers, 1,500 pupils. Postoffice receipts in 1916 were \$22,537. Thirty manufacturing plants are reported, including 7 lumber concerns, porch column factory, sash and door factory, machine foundry, 2 creameries, furniture factory, cross-arms factory and glove factory. Openings are reported for fruit and vegetable cannery;



A machinery and harvester plant at Walla Walla.

combination vinegar, pickle and kraut factory; sash and door factory; brick and tile factory; broom handle factory and box factory.

Chehalis, population 5,000, is the county seat of Lewis County. It has paved streets, cement walks, high and two grade schools, with about 1,000 pupils. Assessed valuation in 1917 was \$1,592,057; postoffice receipts (1916) were \$19,019.15. Its industries include a large furniture factory, a large milk condensery, several creameries, two sawmills, planing mill, shingle mill, vegetable and fruit cannery, a mattress factory and sugar factory. Openings are reported for additional sawmills, brick and tile factories, fir door factory, and potato starch factory.

VANCOUVER, population 10,000, is the county seat of Clarke County and the oldest town in the state. It has an area of nearly 7 square miles, 10 miles of paved and 30 miles of graded streets, and more than 100 miles of concrete walks; 7 public schools with

53 teachers and 1,700 pupils. Its assessed valuation is \$4,486,990 and postoffice receipts (1916) \$24,000.

Located on the Columbia River, it enjoys the advantages of a deep water harbor. All the north and south railroad lines between Portland and Puget Sound points, also the Spokane, Portland & Seattle, pass through. A \$1,600,000 interstate bridge, recently completed, spans the Columbia at this point and brings Vancouver in close connection with Portland, twelve miles away. It is served by street railways which extend to Portland, also to several rural communities. An army garrison of many men is located here.

The principal resources of the surrounding territory are timber and agricultural products. It has saw and planing mills, two ship-building plants, box factory, sash and door factory, two prune packing plants, flour mill, and numerous small industries. Openings are reported for furniture factory, shoe factory and additional ship-yards.

WENATCHEE, population 6,000, county seat of Chelan County, is the center of one of the state's most famous fruit districts. It is located at the confluence of the Wenatchee and Columbia rivers, on the Great Northern railroad and is a junction point for branch roads to Oroville and Mansfield. It is the largest city on this system between Spokane and tide water and is the trading point and commercial center for North Central Washington, which includes Chelan, Okanogan, Douglas and part of Grant County. Large quantities of fruit and wheat are shipped. Its assessed valuation is \$2,666,680 and postoffice receipts for 1916, \$35,051.00. It has 1.5 miles of paved and 13.5 miles of graded streets; a high and four graded schools housing 1,244 pupils.

Its principal industries include two canning and evaporating plants, two meat packing houses, brick yard, dairy plant, flour mill and woodworking mill. Openings are reported for a cider, vinegar or other fruit by-products plant, and a large cannery or evaporator. An additional flour mill and custom machine shop are also requested.

ELLENSBURG, population 6,000, is the county seat of Kittitas County and the commercial center of the Kittitas Valley; the first important agricultural area reached after crossing the Cascades from the population centers of Puget Sound. The main lines of the Northern Pacific and Milwaukee roads provide rail transportation. Light and power are furnished by a municipal hydro-electric plant. The area of the city is 760 acres and its assessed valuation \$2,-787,064. There are 3.29 miles of paved and 6.81 miles of graded streets, and 16 miles of concrete walks. It has 4 public schools with 847 pupils. One of the state normal schools is located here.

The extensive dairying, sheep raising and diversified farming of the tributary country furnishes abundant material for various lines of industry. Two flour mills, three creameries, two sawmills and a glove factory are among its present plants. Opportunities are

reported for a milk condensery, cheese factory and beet sugar factory.

YAKIMA (formerly North Yakima), population 20,000, is the third city in size in Eastern Washington, the county seat of Yakima County, and metropolis of the valley of the same name, which contains the most extensive irrigated section in the state. The United States Reclamation Service is spending large sums of money in this valley. The resources are, naturally, chiefly agricultural. It is one of the most important fruit centers, but diversified farming has also reached vast proportions. Agricultural shipments of the valley were valued at over \$14,000,000 in 1916 and over \$27,000,000 in 1917. It is on the main line of the Northern Pacific railroad, which has several branches radiating from here to neighboring towns, and is served also by the Oregon-Washington Railroad & Navigation Company and by electrics which extend to several outlying districts. Streets are paved. It has a high school, eight graded schools, three



Anacortes manufacturing section.

parochial schools and two colleges. The state fair is held here annually.

Power and light are derived from a plant on the Natches River where 10,400 horsepower have been developed. Present industries include a lumber mill, sash and door factory, box factory, two wood-working plants, beet sugar refinery, cannery, vinegar works, cereal mill, five cold storage plants, cheese factory, three creameries, two foundries, two cement product plants, broom factory, two artificial ice plants and numerous fruit packing houses. Openings are reported for a condensery, evaporator, starch factory, broom factory, alfalfa mill and flour mill.

PASCO AND KENNEWICK: A vantage point in Eastern Washington is found at the head of deep water navigation on the Columbia near its confluence with the Snake River. Several trunk rail-

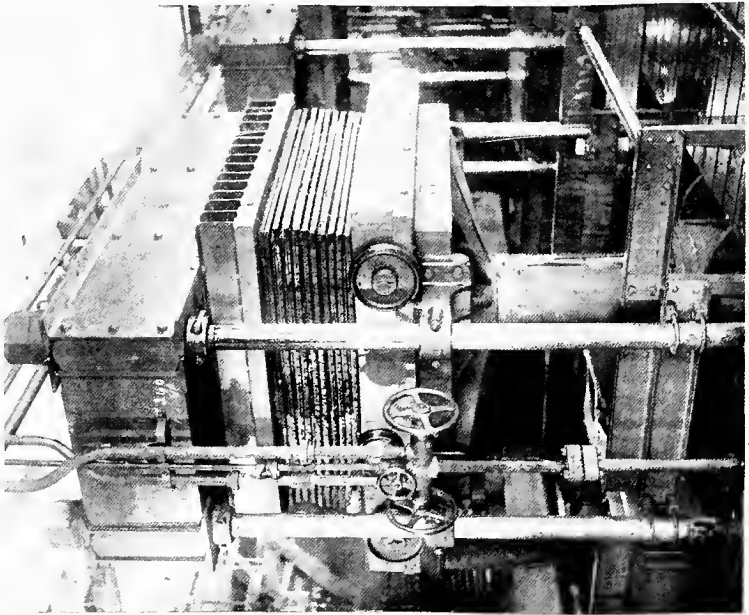
ways converge here and the opening of the Celilo Canal has brought direct boat service to Portland and Pacific Ocean ports. These advantages are shared by two cities, Pasco, county seat of Franklin County, on the east bank, and Kennewick, the largest city in Benton County, on the west bank of the great river. A rich agricultural region includes adjacent irrigated lands and more distant wheat sections. A few miles above is Priest Rapids, capable of generating a half million horsepower.

Pasco, with an estimated population of 3,500, is the division point for the Northern Pacific and Spokane, Portland & Seattle railroads. Besides a 37-stall roundhouse, its industries include sheet metal and iron works, machine shop, woodworking factory, bottling works and cigar factory. A stockyard was recently established. Openings are reported for a woolen mill and wool-scouring plant.

Kennewick, estimated population 2,500, is served by the Northern Pacific, Spokane, Portland & Seattle and Oregon-Washington railroads. Since the opening of the Celilo Canal, a port district has been formed and a large dock constructed. The city has a flour mill, box factory, broom factory, cold storage and bottling works, grape juice factory, sheet metal works and a planing mill. An opening for a cannery is reported.

WALLA WALLA, population 24,000, is the county seat of Walla Walla County, the second city in size in Eastern Washington, the commercial center of Southeastern Washington and a trading point for much of Northeastern Oregon. It is surrounded by one of the richest agricultural sections in the state. The main raw materials are grain, fruits, and livestock products. Cattle and sheep raising and dairying are important. Walla Walla County, and valley extending across the state line, produces annually from 500 to 1,000 cars of apples, about 4,000 tons of prunes, 400 tons of cherries, 200,000 sacks of onions, and 500 tons of asparagus. Wheat production is about 5,000,000 bushels and barley 600,000 bushels annually. Rail transportation is provided by the Northern Pacific and the Oregon-Washington Railroad & Navigation Company. An electric line serves the city and extends to Milton, Oregon. Streets are paved. It has a high school and five grade schools, and is the seat of Whitman College. The state penitentiary is also located here.

Industries include alfalfa, cereal, feed and flour mills; four implement factories, tile factory, meat packing house, cheese factory, creameries and fruit drying plants, three sash and door factories, and many miscellaneous ones. In 1914, forty-seven establishments produced manufactures valued at \$2,014,673. Openings are reported for fruit and vegetable cannery, milk condensery, saw factory, straw broom factory and beet sugar factory.



A fruit hy-product plant at Olympia, showing the flume, and the press with 2,500 pounds pressure per square inch.

EXPLANATION OF TABLES SHOWING ENTERPRISES NEEDED.

The following tabulations represent actual requests from the different communities of the state for the installation of additional manufacturing plants in their vicinities. Together they constitute the main reasons for the publication of this book on "Manufacturing Opportunities in the State of Washington," the foregoing chapters being rather introductory and for the main purpose of throwing light on the extensive and diversified demands which these tables present.

COLLECTING MATERIAL.

In collecting the material contained in these tables and in some of the preceding chapters, questionnaires were sent to public and semi-public officials, business men and other representative citizens in every city and town in the state. Manufacturers in the different lines were also interviewed personally or questioned by letter regarding conditions which applied especially to their industries, and wholesale and retail dealers distributing these products were invited to make suggestions. In addition, a representative of the Bureau made a personal visit to many of the places mentioned.

PROPER USE OF TABLES.

These tables are of necessity neither complete nor conclusive. Their proper use is as a guide to anyone desiring to devote his capital or energy to the installation and management of some manufacturing establishment in Washington. Opportunities may exist in communities not indicated here; perhaps not every opening recorded would justify the erection of a factory. In general, however, these tabulations reflect conditions in the state as a whole and the universal need for additional plants of various kinds.

In studying these lists, it will be observed that in some localities plants similar to those requested have already been established and that in other cases the same industry is being requested by several neighborhoods not far apart. Where this

latter condition exists, it may be considered almost conclusive that one or more such plants are needed somewhere in the vicinity. If properly located, it would serve more than one of the communities now requesting it. Careful investigation in each instance will reveal to the experienced person just which localities offer the best inducements for his line; also whether it would pay to start a plant in a community already possessing one of that kind. These are points for the manufacturer himself to decide.

PRINCIPAL DEMANDS.

A hasty glance at the table shows that the most widely distributed demands next to canneries and by-product plants for utilizing surplus fruits and vegetables, fully discussed in a special chapter, are establishments for conserving other food materials. These are flour and cereal mills, as referred to in the chapter on "Manufactures from Cereals," and factories for utilizing dairy products, as discussed in the chapter entitled "Dairy and Other Livestock Products." The tables show that thirty-seven towns, most of which are located in the wheat belt on the east side of the mountains, ask for flour mills and sixty-eight communities scattered throughout the state are asking for creameries, cheese factories and milk condenseries.

Next in importance after food products come the timber products, and closely following them are those establishments depending upon the mineral resources, both metallic and non-metallic, all of which have been considered in separate chapters.

For the utilization of forest products, sawmills are requested by fifty communities, paper mills by sixteen, and shingle mills by twelve; while ten localities ask for woodworking plants, ten for furniture factories, nine for sash and door factories, twenty-four for box factories, and fifteen for shipyards.

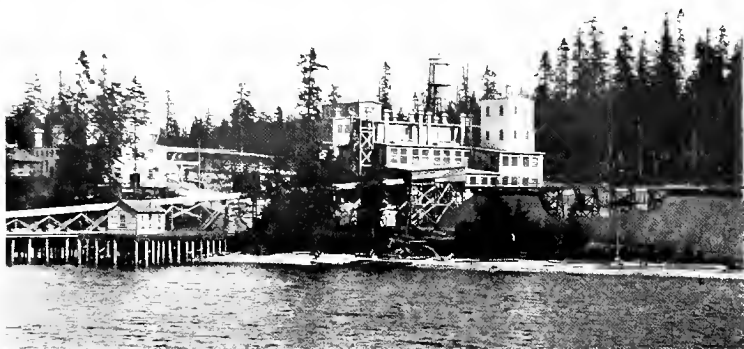
Requests for plants to utilize non-metallic minerals include fifteen for brick and tile factories, eight for pottery plants, one for briquettes, two for coal by-products, two for glass, two for silica mills, one for marble, three for cement, three for concrete blocks and four for lime. Metal working plants include six requests for smelters, one for ore concentrator and several for foundries or other iron working establishments.

MISCELLANEOUS DEMANDS.

There are also four requests for alfalfa mills, four for broom factories, two for shoe factories, five for strawboard factories, six for fish canneries, two for codfish packing, four for laundries, two for woolen mills, three for the development of water power, one for a tannery, and one for packing house; also demands for establishments to manufacture aprons, bottles, buttons, charcoal, cigars, tannic acid, trunks and various other miscellaneous products. Altogether, about five hundred requests are tabulated and 275 different communities are represented.

ARRANGEMENT OF MATERIAL.

For the sake of convenience to the investigator, these tables have been arranged two ways, the first by industry needed and the second by the cities requesting them. The cities have been grouped by counties in order that one may more readily observe what contiguous communities request similar factories. The alphabetical plan has been followed in all arrangements.



A sulphurous acid plant near Port Townsend.

MANUFACTURING ESTABLISHMENTS REQUESTED BY CITIES, TOWNS AND VILLAGES.

Dagger (†) indicates that similar enterprise is already operating in community.

Star (*) indicates commercial organization; where none is given make inquiry of postmaster.

<i>Name of Enterprise, Postoffice and County</i>	<i>Probable Capital Required</i>	<i>Material Available</i>	<i>Encouragements Offered</i>
Alfalfa Mill			
*Mabton, Yakima	\$10,000	Large acreage...	Site and ass't.
*Topinish, Yakima		Great quantity..	Liberal support.
*Yakima, Yakima	10,000	20,00 acres.....	Cheap sites.
Apron Factory			
*Bremerton, Kitsap			
Bottling Works			
*Puyallup, Pierce			
Box Factory			
*Arlington, Snohomish			
Carlisle, Grays Harbor....	10,000	Much spruce....	
*Centralia, Lewis	3-5,000	Large amount....	Substantial.
Chattaroy, Spokane			Probably site.
Chester, Spokane			
*Colville, Stevens	10-15,000	Abundant	Free site.
*Goldendale, Klickitat		Fine pine.....	
Keller, Ferry			
Kennydale, King		Much lumber....	
Kirkland, King		Large supply....	Assistance.
*Lyle, Klickitat	5-10,000		
Malott, Okanogan			
*Marysville, Snohomish			
*Monroe, Snohomish			
*Montesano, Grays Harbor		Abundant	
*North Bend, King		Plenty	
*Northport, Stevens			
*†Orient, Ferry	1,500	Within mile....	
*Port Orchard, Kitsap	3,000	Yes	Liberal aid.
*Steilacoom, Pierce			Site.
*Sylvan, Pierce	5,000		Site.
Tiger, Pend Oreille		Abundant	Site.
*Vashon, King	5,000	Shipped in.....	
Winesap, Chelan	10,000	Abundant	Assistance.
Brick and Tile			
Battleground, Clarke	3,000	Plenty	
*Centralia, Lewis	5-6,000	Convenient	Substantial.
*Cheney, Spokane		Good supply....	
*Chehalis, Lewis	Small	Excellent clay...	Assistance.
*Colville, Stevens		Two deposits....	Site.
Granger, Yakima	30-50,000	Large quantity..	
*Kittitas, Kittitas		Clay tests well..	
Littell, Lewis	2,000	40 acres fine clay	
Marble, Stevens	500	Good supply....	
Othello, Adams	Small	Cheap and near..	
*Port Angeles, Clallam ...	3-15,000	Abundant	Long lease.
Roslyn, Kittitas	Small	Plenty	
Ruff, Grant		Clay 10 miles...	
Wahluke, Grant		Abundant	
*Winlock, Lewis	Small	Close to plant...	

<i>Name of Enterprise, Postoffice and County</i>	<i>Probable Capital Required</i>	<i>Material Available</i>	<i>Encouragements Offered</i>
Briquetting Plant			
*Castle Rock, Cowlitz		Plenty of coal . . .	
Broom Factory			
*Bellingham, Whatcom	1-5,000	Wood for handles	
Colville, Stevens		Can be raised . . .	
Methow, Okanogan			
Sultan, Snohomish			
Button Factory			
*Montesano, Grays Harbor		Plenty of shells . .	
Cannery or Evaporator			
Algona, King	1-3,000	Abundance	Assistance.
*Auburn, King	20,000		
Benton City, Benton	40,000	Fruit and veg. . .	Site.
Byron, Yakima	500-1,000		
*†Carnation, King	20,000		Cooperation.
Carson, Skamania	Small		
*Centralia, Lewis	2,000	Much fruit	Assistance.
Chetlo, Pacific	1,500		
Clarkston, Asotin	10,000		Assistance.
Colfax, Whitman	5,000	Fruit and veg. . .	Assistance.
Deep River, Wahkiakum	2,500	Much fruit	Cheap site.
Dewey, Skagit	Small		Site.
Elma, Grays Harbor	5,000		Assistance.
Factoria, King	10,000		Site.
*Farmington, Whitman		Abundance	Assistance.
Ferndale, Whatcom	2,000		
Forks, Clallam	3-5,000	Plenty fruit . . .	
*Gifford, Stevens	Small		Site.
*Goldendale, Klickitat			
Grandview, Yakima	20-25,000	Large acreage . .	Site.
Grant, Mason		Berries	
*Hanford, Benton	10,000	Abundant	Site and stock.
Harvey, Stevens	5,000		Site.
*Kennewick, Benton	25-30,000	Hundreds of acres.	Assistance.
Kennydale, King			
*Kent, King	10-15,000		
Kiona, Benton	Small		
†Langley, Island	5,000		Assistance.
Lincoln, Lincoln	5,000		Site.
Lisabeula, King	Small	Fruit and berries	
Littell, Lewis	10,000	Fruit and berries	Assistance.
Loomis, Okanogan	3,000		
*Mabton, Yakima	5-10,000		Site.
Manson, Chelan	5,000	Unlimited	Support.
Matlock, Mason	Small	Large amount . .	Assistance.
Marysville, Snohomish			
Medina, King			
*Methow, Okanogan	1,000	Soft fruits	
Monitor, Chelan	500-1,000	Fruit	
Mossyrock, Lewis	2,000	Fruit	
*Mt. Vernon, Skagit	25,000		
Nellita, Kitsap	1,000		Site.
North Bend, King	Small		

<i>Name of Enterprise, Postoffice and County</i>	<i>Probable Capital Required</i>	<i>Material Available</i>	<i>Encouragements Offered</i>
Cannery or Evaporator—Cont.			
Orchards, Clarks .....	.....	Berries	Site.
Oroville, Okanogan	8-20,000	Abundant	Site.
Palisades, Douglas	1,500	700 a. orchard..	Site and ass't.
Peach, Lincoln	3-4,000	Fruit	
*Portage, King	5,000	.....
*Port Orchard, Kitsap	5,000	Near	Liberal.
Poulsbo, Kitsap	2,000	Small fruits....	Reasonable.
Randle, Lewis .....	.....	.....
*Renton, King .....	.....	.....
*Rolling Bay, Kitsap	2,000	Fruit and veg...	Assistance.
*Sequim, Clallam	25,000	Good fruit dist..	Site and bonus.
Sifton, Clarke .....	.....	Fruit district...	Site.
South Colby, Kitsap	7,000	Near	
Stratford, Grant .....	.....	Sufficient	
Steilacoom, Pierce	Small	Large amount...	Site.
Sultan, Snohomish .....	.....	.....	Site.
Sumas, Whatcom	3-4,000	Berries	Site.
Sundale, Klickitat .....	.....	.....	Site.
Swofford, Lewis	8-10,000	Plenty fruit....	
*Sylvan, Pierce	5,000	Plenty	Site.
Tekoa, Whitman .....	.....	Garden produce.	Assistance.
Timber Valley, Klickitat..	.....	.....	Site.
Touchet, Walla Walla.....	.....	.....
Tracyton, Kitsap	Small	Fruit and berries	
Tukwila, King	5,000	Fine fruit belt..	
†Vashon, King .....	.....	.....
*Walla Walla, Walla Walla.	.....	Fine fruit.....	
Wawawai, Whitman	Small	.....
*Wenatchee, Chelan .....	.....	Much fruit.....	
West Sound, San Juan.....	15-20,000	Abundant	
*White Salmon, Klickitat..	.....	.....
*Winslow, Kitsap .....	.....	Small fruit....	
*Woodland, Cowlitz .....	.....	Fruit and veg...	
*†Yakima, Yakima	75,000	.....	Liberal.
*Zillah, Yakima	Small	Abundance	
Cement Works			
*Asotin, Asotin	200,000	Unlimited	
Berlin, King .....	.....	In abundance...	
Hartford, Snohomish	1,000,000	In abundance...	Site.
Cereal and Feed Mill			
*Anacortes, Skagit .....	.....	Locally grown...	Assistance.
*Burlington, Skagit .....	.....	Locally grown...	Site.
*Northport, Stevens	1,000	Locally grown...	
Charcoal			
Roslyn, Kittitas	Small	Plentiful	
Cheese Factory			
Ariel, Cowlitz	2-300	Dairying	Site.
*Auburn, King	5,000	Much milk.....	
Clinton, Island	3-5,000	Abundance	Site.
*Colville, Stevens .....	.....	.....	Site.
East Stanwood, Snohomish	10,000	Dairy country ..	Assistance.

<i>Name of Enterprise, Postoffice and County</i>	<i>Required Capital Probable</i>	<i>Material Available</i>	<i>Encouragements Offered</i>
Cheese Factory—Continued.			
Eden, Wahkiakum	5,000	.....	.....
*Ellensburg, Kittitas	Small	Dairy region....	Assistance.
Etna, Clarke	3-4,000	Dairy region....	Site.
Hunters, Stevens	5,000	.....	.....
Kapowsin, Pierce	Small	Dairy region....	Site and ass't.
Oakville, Grays Harbor...	3,000	Dairy region....	Site.
*Quinault, Grays Harbor...	2,500	Dairy region....	Site.
Stowe, Douglas	Small	.....	Free lease.
Swofford, Lewis	5,000	.....	.....
Van Buren, Whatcom .....	.....	Abundance .....	.....
Cigar Factory			
*Puyallup, Pierce	Small	.....	.....
Coal By-Products			
Factoria, King	250,000	Cheap coal....	Site and siding.
*Issaquah, King	400,000	Abundance .....	.....
Codfish Packing			
*Anacortes, Skagit .....	.....	Abundance	Assistance.
Poulsbo, Kitsap	25-50,000	Unlimited	Reasonable.
Concrete Blocks			
Burbank, Walla Walla....	800	Excellent	Site.
Keller, Ferry	500	Plenty .....	.....
*Port Orchard, Kitsap	500	Plenty	Assistance.
Cooperage Plant			
*Hoquiam, Grays Harbor...	.....	Abundance	Site.
Creamery			
Adrian, Grant	2-3,000	Abundant	Site.
Algona, King	1-2,000	For small plant.	.....
Almota, Whitman	5,000	.....	.....
*Auburn, King	5,000	Much milk .....	.....
Carson, Skamania	2,000	.....	Support.
Cedonia, Stevens .....	.....	Shipping cream.	Site.
Chattaroy, Spokane .....	.....	Shipping cream.	Site.
Clayton, Stevens	Small	Shipping cream..	.....
Clinton, Island	3,000	Dairying	Site.
Cosmopolis, Grays Harbor.	5,000	Dairy country...	.....
Dorr, Klickitat	Small	.....	.....
Edwall, Lincoln .....	.....	Dairy country...	.....
Fishtrap, Lincoln	Small	.....	Site.
*Gifford, Stevens .....	.....	Shipping cream.	Site.
Gig Harbor, Pierce	7-8,000	Abundant .....	.....
*Goldendale, Klitckitat .....	.....	.....	.....
Graham, Pierce	Small	.....	.....
Hover, Benton	Small	Dairying .....	.....
Kendall, Whatcom	3-5,000	300 cows.....	.....
*Kittitas, Kittitas .....	.....	.....	.....
Latah, Spokane	5,000	.....	.....
Lawrence, Whatcom .....	.....	.....	.....

<i>Name of Enterprise, Postoffice and County</i>	<i>Probable Capital Required</i>	<i>Material Available</i>	<i>Encouragements Offered</i>
Creamery—Continued.			
Matlock, Mason	Small	Dairy section....	Site.
Mayfield, Lewis			
Mount Solo, Cowlitz	5-10,000	Fine herds.....	
*North Bend, King			
*Northport, Stevens	1-5,000	Dairy country...	
Oakville, Grays Harbor...	3,000	1,000 cows.....	Site.
Pe Ell, Lewis	500-1,000	Good dairy land.	
Prescott, Walla Walla....	5-10,000		Site.
*Quiniault, Grays Harbor..	2,500	Dairy region....	Site.
Ramapo, Clallam	3,000	Dairying	
Renton, King			
Spangle, Spokane	Small	Shipping cream..	
Steilacoom, Pierce	Small		
Timber Valley, Klickitat..		Plenty of cows..	
Touchet, Walla Walla....	2,500	Plenty of cows..	Site.
Valley, Stevens		Plenty of cows..	
Evaporator—(See Cannery or Evaporator)			
Fish Cannery			
Chinook, Pacific			
Dewey, Skagit		Puget Sound....	Site.
†Kelso, Cowlitz.....			
Mukilteo, Snohomish			
Nellita, Kitsap			
Pysht, Clallam			
Flour Mill			
Adrian, Grant			Site.
Albion, Whitman			
Alderdale, Klickitat	10-20,000	Plenty	Site.
Alstown, Douglas	4-5,000	Plenty	
Alta Vista, Lewis.....	4-5,000	Local wheat....	
Bonita, Douglas		Plenty	Site.
Chelan Falls, Chelan.....			
†Cheney, Spokane	15,000	Plenty	Substantial help
Clarkston, Asotin	17,000		
Connell, Franklin	20-50,000	Fine wheat	Site.
Edwall, Lincoln	15-20,000	350,000 bushels.	
Ephrata, Grant	50,000	Million bu.wheat	Site.
Huntsville, Columbia	10-20,000		
Kahlotus, Franklin		Plenty	
Krupp, Grant		7,000,000 bu....	
Leavenworth, Chelan			Site and ass't.
Lyle, Klickitat	5-10,000		Site.
Moses Lake, Grant.....		Plenty	Help.
Nespelem, Okanogan			
Oroville, Okanogan		Plenty	Site.
Othello, Adams		Abundant	
*Palouse, Whitman	40,000	Abundant	Assistance.
*Pateros, Okanogan	20,000	Large quantities.	Site.
*Quincy, Grant	10,000	Ample	Site.
*Ritzville, Adams	40,000		Site.

<i>Name of Enterprise, Postoffice and County</i>	<i>Probable Capital Required</i>	<i>Material Available</i>	<i>Encouragements Offered</i>
Flour Mill—Continued.			
*Rosalia, Whitman	25,000	Grain	Assistance.
Ruff, Grant	20-30,000	High quality	
Spangle, Spokane . . . . .	. . . . .	. . . . .	Aid.
St. John, Whitman	10,000	Large amount	
Starbuck, Columbia	15,000	Abundant	Assistance.
Synarep, Okanogan	5-6,000	Abundant	
Sundale, Klickitat . . . . .	. . . . .	50,000 bushels	Site.
*Toppenish, Yakima . . . . .	. . . . .	. . . . .
Touchet, Walla Walla . . . . .	. . . . .	. . . . .	Site.
Twisp, Okanogan	10-12,000	Plenty	
Uniontown, Whitman	10,000	Plenty	Site.
Warden, Grant	25,000	Good wheat	
Washtucna, Adams	50,000	Abundant	Site.
Weber, Adams . . . . .	. . . . .	Abundant	
Foundry and Machine Shop			
*†Anacortes, Skagit . . . . .	. . . . .	. . . . .	Assistance.
Tuckwila, King	500,000	Cheap coal	
Furniture			
*Anacortes, Skagit	Small	Abundant	Assistance.
*Bellingham, Whatcom	5-50,000	Abundant	
Coupeville, Island	Small	Rustic timber	Site.
*†Everett, Snohomish	50,000	Locally	
*Hoquiam, Grays Harbor . . . . .	. . . . .	. . . . .	Site.
*Port Angeles, Clallam	2,000	Abundant	
*Renton, King . . . . .	. . . . .	. . . . .	Assistance.
*Sumner, Pierce . . . . .	. . . . .	. . . . .
*Vancouver, Clarke	10-25,000	. . . . .	Assistance.
Washougal, Clarke . . . . .	. . . . .	Plenty	
Fruit By-Products			
*Cashmere, Chelan	10,000	Much waste	Site.
Chelan Falls, Chelan	Small	Much waste	
Denison, Spokane . . . . .	. . . . .	Much waste	Free lease.
Dryden, Chelan . . . . .	. . . . .	. . . . .
Entiat, Chelan . . . . .	. . . . .	Much waste	Aid.
Farmington, Whitman . . . . .	. . . . .	Much waste	
Ferndale, Whatcom	2,500	. . . . .	Aid.
Four Lakes, Spokane . . . . .	. . . . .	Much waste	
Kiesling, Spokane	10,000	Waste fruit	Aid.
Mabton, Yakima	Small	
Orondo, Douglas	Small	Much waste	Aid.
Peshastin, Chelan	3-4,000	
*Pullman, Whitman . . . . .	. . . . .	. . . . .	Aid.
*Rosalia, Whitman	2,000	
Throp, Kittitas . . . . .	. . . . .	Waste fruit	Aid.
*Toppenish, Yakima . . . . .	. . . . .	Waste fruit	
*Yakima, Yakima	Small	Much waste	Aid.
Glass			
*Port Angeles, Clallam . . . . .	. . . . .	Abundant	Assistance.
*Spokane, Spokane	100,000	Abundant	

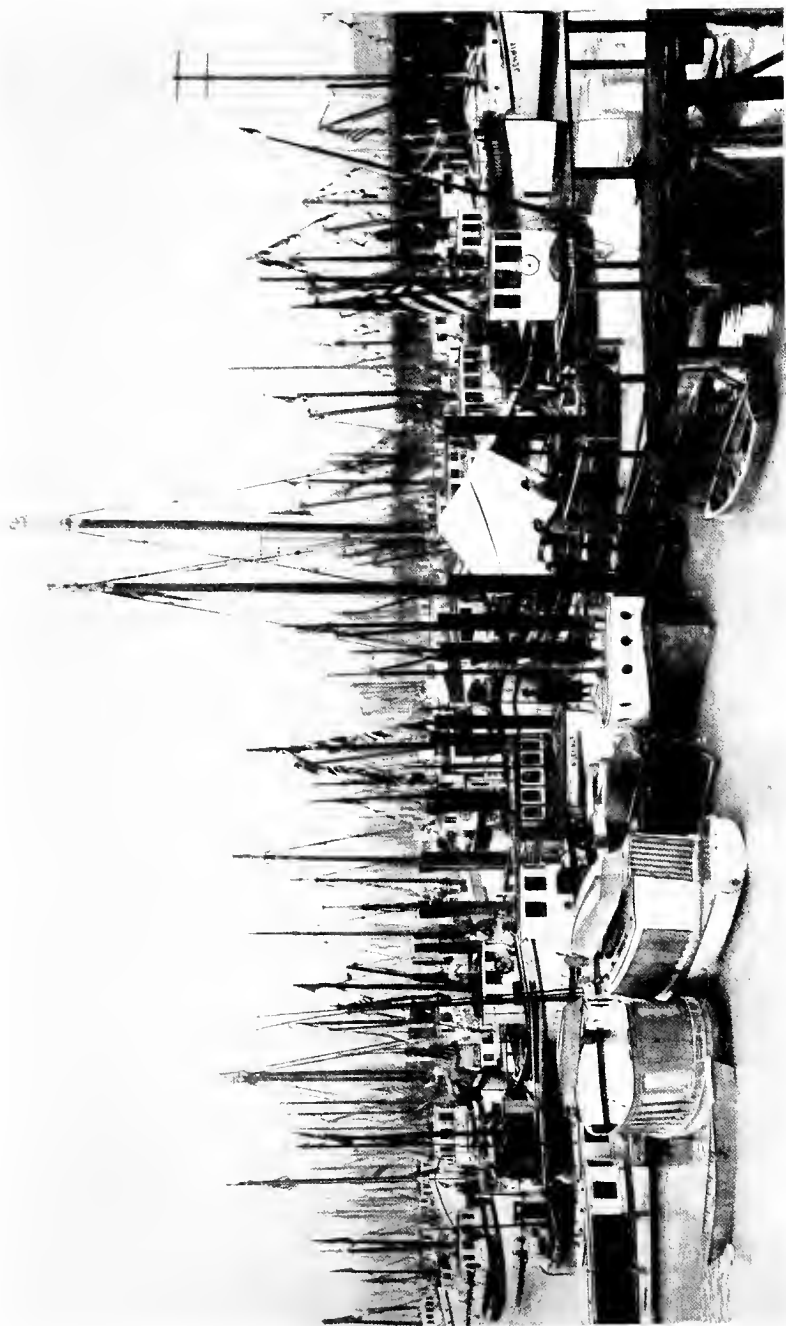
<i>Name of Enterprise, Postoffice and County</i>	<i>Probable Capital Required</i>	<i>Material Available</i>	<i>Encouragements Offered</i>
Implement			
Lind, Adams	20,000	Ship in.....	Site and bonus.
*Odessa, Lincoln .....		.....
*Ritzville, Adams		Imported	Site.
Laundry			
Ferndale, Whatcom	1,500	.....
Marcus, Stevens .....		.....
*Quincy, Grant .....		.....
*Rosalia, Whitman .....		.....
Lime Plant			
Dolphin, San Juan.....		Small mountain.	
Granite Falls, Snohomish.	5,000	Agricultural rock	
Lochloy, Snohomish		Large deposits..	
Orondo, Douglas		Inexhaustible ...	
Malleable Iron Works			
*Hoquiam, Grays Harbor..		Import	Sites.
*Vancouver, Clarke	10-25,000	Import	Assistance.
Marble Works			
Marble, Stevens		Large supply....	
Milk Condensery			
*Arlington, Snohomish .....		.....
*Burlington, Skagit		6,000 cows.....	Site.
Cheney, Spokane	5-10,000	Sufficient	Site.
Ellensburg, Kittitas		Plenty milk.....	
Eveline, Lewis		Local supply....	Lease.
McMurray, Skagit .....		.....	Site.
*Montesano, Grays Harbor.		.....
Orchards, Clarke .....		.....	Assistance.
Orting, Pierce		Lots of milk....	Assistance.
Ridgefield, Clarke.....		Many cows.....	
*Sequim, Clallam	50,000	3,000 cows.....	Site and bonus.
*Sumner, Pierce		Sufficient	
*Walla Walla, Walla Walla.	25-50,000	Plenty	Site.
*Woodland, Cowlitz		Large amt. milk.	Assistance.
*Yakima, Yakima .....		.....	Assistance.
Ore Concentrator			
Covada, Ferry	2,500	\$60,000 ore on dumps.	
Packing House			
Loomis, Okanogan	Small	.....
Paper Mill			
*Aberdeen, Grays Harbor..	1,000,000	Large quantities.	Assistance.
Bay City, Grays Harbor...	500,000- 1,000,000	Large quantities	

<i>Name of Enterprise, Postoffice and County</i>	<i>Probable Capital Required</i>	<i>Material Available</i>	<i>Encouragements Offered</i>
Paper Mill—Continued.			
*Bellingham, Whatcom . . .	50,000	Vast amount. . .	Assistance.
*Castle Rock, Cowlitz . . .	200,000	Wood and power	Site.
Cosmopolis, Grays Harbor			Site.
*Hoquiam, Grays Harbor			Assistance.
Keller, Ferry		Cottonwood and spruce.	
Locke, Pend Oreille		Plenty	
Metaline Falls, P. Oreille		Wood and power	
*Monroe, Snohomish			Assistance.
*Northport, Stevens	50,000- 100,000	Plenty	
*Renton, King			
*Snohomish, Snohomish		Plenty	
Telma, Chelan	2,000	Cottonwood . . .	Assistance.
Tiger, Pend Oreille		Plenty of wood..	
*Vancouver, Clarke	50,000- 100,000	Abundant	Assistance.
Pickle Plant			
Cheney, Spokane		Plenty	Assistance.
*Sumner, Pierce		Vinegar produced	
Wheeler, Grant		Abundant	
Piles			
*Quilcene, Jefferson	25,000	100,000 pieces..	
Pottery			
*†Bellingham, Whatcom . . .	25-75,000		
Deer Park, Spokane	10,000		
*Edmonds, Snohomish		Excellent	
*Kelso, Cowlitz		Good clay.	Assistance.
Lyle, Klickitat	4-5,000		
Orondo, Douglas		Inexhaustible . . .	
*Spokane, Spokane	35-50,000	Sufficient	
Tahuya, Mason		Good clay.	
Sash and Door			
*Blaine, Whatcom.			
*Castle Rock, Cowlitz		Abundant	Assistance.
*Centralia, Lewis	3-5,000	Plenty	Assistance.
*Chehalis, Lewis	25,000		Assistance.
*†Hoquiam, Grays Harbor.		Abundant	Assistance.
Lakeview, Pierce	10,000		
Lyle, Klickitat	5,000		
Stevenson, Skamania	250		Assistance.
*Winlock, Lewis	10,000	Local mills.	Site and ma- terial.
Saw Mill			
Alder, Pierce	1000,000	Large quantity.	Free site.
Allyn, Mason	Small		
Bangor, Kitsap	2,000	Plenty	
Berlin, King	25-50,000	Million ft. fir. . .	Site.
Bismark, Pierce.	20,000	Plenty	

<i>Name of Enterprise, Postoffice and County</i>	<i>Probable Capital Required</i>	<i>Material Available</i>	<i>Encouragements Offered</i>
Saw Mill—Continued.			
Camden, Pend Oreille . . .	8,000	Some	
Corvallis, Cowlitz	100,000	Close	
Cathlamet, Wahkiakum . .	10,000	Plenty	
*Chehalis, Lewis	25,000	Unlimited	Assistance.
Detroit, Mason			
Elbe, Pierce	100,000	Plenty	
†Entiat, Chelan	100,000	Millions feet . . .	
Frances, Pacific		Plenty	
Grays River, Wahkiakum .	5-10,000	Abundant	
Hadlock, Jefferson	Any amt.		
Houghton, King	Small		Site.
†Kapowsin, Pierce		Plenty	
Keller, Ferry	Small	Near	
Langley, Island	Small	Plenty	
*Lincoln, Lincoln	5,000	Plenty	Site.
Lindberg, Lewis	30,000	Unlimited	
*Lyle, Klickitat	25,000- 100,000	Billion feet	Site.
Marble, Stevens		15,000,000 feet..	
Melbourne, Grays Harbor .		All around	
Nespelem, Okanogan			
†Olympia, Thurston		Plenty	
Orin, Stevens		Plenty	
Orting, Pierce	5-20,000	Plenty	
Park Rapids, Stevens	4-10,000	Plenty	
Pateros, Okanogan	20,000	Four billion feet.	Site.
Pe Ell, Lewis		Plenty	
Piedmont, Clallam	2-3,000	Abundant	
*Port Townsend, Jefferson .	35,000	Abundant	
Puget, Thurston		Plenty	
Pysht, Clallam		Large amount . . .	
*Quilcene, Jefferson	25,000	Unlimited	
Reeveton, Clallam	25,000- 100,000	Unlimited	Site.
Saratoga, Island	2,000	Large amount . . .	Site.
Silverton, Snohomish	5-10,000	Plenty	
South Prairie, Pierce	5-20,000	Plenty	Help.
Steilacoom, Pierce		Plenty	
Synarep, Okanogan	10,000	Plenty	
Tahuya, Mason	15,000	Plenty	
†Timber Valley, Klickitat . .	5,000	Plenty	
*Toledo, Lewis	Small		
Tum Tum, Stevens	10,000		Site.
Turk, Stevens	5-10,000	Plenty	
Union City, Mason		Plenty	Site.
*White Salmon, Klickitat . .			
*Woodland, Cowlitz		Up Lewis river . .	Assistance.
Shingle Mill			
Berlin, King	5,000	Plenty of cedar . .	
Buckley, Pierce	2,000	Plenty of cedar . .	
*Carnation, King	15-25,000	Sufficient	Cooperation.
Cathlamet, Wahkiakum . .	10,000	Large bodies of timber.	

<i>Name of Enterprise, Postoffice and County</i>	<i>Probable Capital Required</i>	<i>Material Available</i>	<i>Encouragements Offered</i>
Shingle Mill—Continued.			
Gardiner, Jefferson		Plenty of cedar..	Site.
Gig Harbor, Pierce		Plenty	
Melbourne, Grays Harbor		Plenty	
*†Orting, Pierce	3-5,000	Nearby	
*Quilcene, Jefferson	20,000	Plenty of cedar..	
Scenic, King	8-10,000	Plenty of cedar..	
Shine, Jefferson	4,000	Plenty of cedar..	
Stabler, Skamania	5,000	Plenty of cedar..	
Ship Building			
*Anacortes, Skagit	3-5,000	Much lumber...	Assistance.
Blaine, Whatcom .....		.....
Cosmopolis, Grays Harbor		Lumber and site.	Free site.
Everett, Snohomish	100,000- 300,000	Abundant	Free site.
†Hadlock, Jefferson		Good material...	Lease of site.
†Kirkland, King		Fresh water har- bor.	Site.
Mukilteo, Snohomish .....		.....
*Port Orchard, Kitsap	30,000	Near at hand...	Site.
*Port Townsend, Jefferson ..	10,000	Available	Site and aid.
*Poulsbo, Kitsap	25,000- 100,000	Available	Assistance.
Raymond, Pacific .....		.....	2 sites.
*Rolling Bay, Kitsap		Available	
*South Bend, Pacific		Plenty; also foundry.	Support.
*Snohomish, Snohomish .....		.....
Steilacoom, Pierce		Convenient	Aid.
*†Vancouver, Clarke	25,000	Abundant	Site and ass't.
Shoe Factory			
*Spokane, Spokane	40-75,000	Imported	Assistance.
*Vancouver, Clarke	10-25,000	Imported	Aid.
Silica Mill			
†Roza, Kittitas	10,000	Abundance	
Wymer, Kittitas	4-5,000	Vast deposits...	
Silo Factory			
*Colville, Stevens		Good	Site.
Smelter			
Glacier, Whatcom		Low grade ore..	
Manson, Chelan		Low grade ore..	
Miles, Lincoln		Large bodies ore.	
Pateros, Okanogan		Large bodies ore.	Site.
Silverton, Snohomish		Large bodies ore.	
Winthrop, Okanogan	10,000	Plenty	Site.

<i>Name of Enterprise, Postoffice and County</i>	<i>Probable Capital Required</i>	<i>Material Available</i>	<i>Encouragements Offered</i>
Sugar Factory			
*Ellensburg, Kittitas		Fine beets.....	
Kittitas		Fine beets.....	
Mabton, Yakima	500,000	Fine beets.....	
*Orting, Pierce		Good beet land..	Assistance.
*Ritzville, Adams .....		.....	Sites.
Starch Factory			
*Chehalis, Lewis		Plenty potatoes..	
*Kelso, Cowlitz		Plenty potatoes..	
*Montesano, Grays Harbor .....		.....
Ridgefield, Clarke		Many potatoes..	
*Ritzville, Adams .....		.....	Site.
*Toppenish, Yakima		Fine potatoes...	
*Waterville, Douglas		Cheap potatoes..	Assistance.
Strawboard and Paper			
*Anacortes, Skagit		LaConner flats..	Assistance.
*Burlington, Skagit		Lots of straw...	Site.
Palouse, Whitman	100,000	Abundant straw.	
*Pullman, Whitman		Abundant straw.	
*Walla Walla, Walla Walla		Abundant straw.	
Tanic Acid Factory			
*Port Angeles, Clallam ...	5,000	Hemlock bark...	Assistance.
Tannery			
*Port Angeles, Clallam ...	15,000	Import hides....	Assistance.
Ties (railroad)			
†Pigeon Springs, Cowlitz...	2-4,000	Plenty tie timber	
Toy Factory			
*South Bend, Pacific		Plenty of lumber	Assistance.
Trunk Factory			
*†Spokane, Spokane	15-25,000	Local and im- ported.	Assistance.
Water Power Development			
Gettysburg, Clallam	10,000	Lyre river.....	
*Lyle, Klickitat	25-50,000	Klickitat river..	
*Quilcene, Jefferson	100,000	Quilcene river...	
Woodworking Plant			
Deep River, Wahkiakum..	20,000	Several mills....	Site.
*†Hoquiam, Grays Harbor		Much lumber....	Assistance.
*Kelso, Cowlitz		Local mills....	Assistance.
Leese, Okanogan	5,000	Four mills.....	
Orting, Pierce	10,000	Much timber....	Cheap site.
*Poulsbo, Kitsap	1-50,000	Some kinds....	Aid.
Woolen Mill			
Pasco, Franklin	50,000	Vicinity.....	Site.
*Wenatchee, Chelan		Vicinity	
Wool Scouring			
*Pasco, Franklin	10,000	Vicinity	Site.



A Puget Sound fishing fleet. "Washington's fisheries resources are the greatest of all states in the union and also the best fish, species for species."

CITIES, TOWNS AND VILLAGES REPORTING OPENINGS FOR MANUFACTURING ENTERPRISES; ARRANGED BY COUNTIES.

ABBREVIATIONS USED.

Bellevue & Northern.....	B. & N.	Interurban.....	Int.	Spokane Falls Northern.....	S. F. N.
Branch.....	Br.	Northern Pacific.....	N. P.	Spokane International.....	S. I.
Canadian Pacific.....	C. P.	Oregon-Washington Railroad & Navigation Co.....	O.-W.	Steamer.....	Str.
Chicago, Milwaukee & St. Paul.....	C. M. & St. P.	Seattle, Portland & Spokane.....	S. P. & S.	Tacoma Eastern.....	T. E.
Great Northern.....	G. N.			Wenatchee Valley & Northern.....	W. V. N.

* Indicates a commercial organization in community; where none exists make inquiry of postmaster.

County and City or Postoffice	Population		Transportation	Resources	Industries Requested
	1910 Census	1917 Estimate			
ADAMS					
Lind	831	1,000	G. N.; C. M. & St. P.	Farming; wheat	Traction engine factory.
*Othello	600	600	C. M. & St. P.	Farming; wheat	Small brick yard; flour mill.
*Ritzville	1,859	2,300	N. P.	Farming; wheat	Beet sugar factory; starch factory; combine harvester factory; flour mill.
Washitucna	300	350	S. P. & S.; O.-W.	Wheat raising	Flour mill.
Webber			N. P.	Wheat raising	Flour mill.
ASOTIN					
*Asotin	820	1,400	Steamer	Cement material	Cement factory.
*Clarkston		1,700		Farming	Fruit dryer; flour mill.
BENTON					
Benton City		50	N. P.; O.-W.	Farming; fruit	Cannery and evaporator.
*Hanford		250	Br. C. M. & St. P.	Farming; fruit	Cannery.
Hoyer		100	S. P. & S.	Farming; fruit	Creamery.
*Kennewick	1,219	2,000	N. P.; S. P. & S.; Br. O.-W.; steamer.	Farming; fruit	Cannery.
CHELAN					
*Cashmere		1,000	G. N.	Farming; fruit	Fruit by-products.
*Chelan Falls		125	G. N.; steamer	Farming; fruit	Cannery; flour mill.
Dryden			G. N.	Farming; fruit	Fruit by-products.
*Entiat		300	G. N.	Farming; fruit	Fruit by-products; saw mill; box factory.

*Leavenworth	1,551	2,100	G. N.; W. V. N.	Farming; fruit	Flour mill.
*Manson		300	Auto to railroad.	Mining; orcharding	Smelter; cannery.
Monitor		30	G. N.	Farming; orcharding	Fruit drying plant.
Peshasth			G. N.	Farming; orcharding	Fruit by-products.
Telma		150	Stage		Pulp mill.
*Wenatchee	4,050	6,300	G. N.	Farming; orcharding	Evaporator; cannery; woolen mill.
Winesap		175	G. N.; river	Farming; mining	Box factory.
CLALLAM					
Forks		150	Stage to Sound.	Farming; timber	Cannery.
Gettysburg		100	C. M. & St. P.; steamer.	Timber	Drain tile; power development.
Piedmont		25	5 miles to railroad; lake.	Timber	Saw mill.
*Port Angeles	2,286	5,500	C. M. & St. P.; steamer.	Timber, etc.	Tannic acid; tannery; furniture; brick and tile.
Pysht		25	Steamer	Timber; fishing	Saw mill; pulp mill; salmon cannery.
Ramapo			C. M. & St. P.; auto stage.	Dairying	Creamery.
Reeveton			C. M. & St. P.	Timber	Saw and shingle mill.
*Sequim		600	C. M. & St. P.; steamer.	Dairying; farming	Condensery; cannery; nursery.
CLARKE					
Battleground		400	N. P. branch	Timber	Brick and tile.
Brush Prairie		125	N. P.; auto truck.	Farming; dairying	Creamery.
Etna		45	Steamer	Farming; dairying	Cheese factory.
Orchards		400	Auto truck; interurban.	Farming; fruit	Condensery; cannery.
*Ridgefield		600	Rail and water.	Dairying; farming	Condensery; starch factory.
Sifton			Rail and auto truck.	Dairying; farming	Cannery.
*Vancouver	9,300	10,000	5 railroads; deepwater steamers.	Farming; fruit; dairying	Grain elevators; furniture; pulp mills; shoes; shipbuilding; iron works.
*Washougal	456	1,000	Water and rail.	Farming; dairying	Furniture.
Yacolt	435	475	N. P. branch	Timber; farming	Laundry.
COLUMBIA					
Huntsville		225	N. P.; O.-W.	Wheat	Flour and feed mill.
Starbuck	761	850	O.-W.	Wheat	Flour mill.
COWLITZ					
Ariel		500	16 miles to railroad.	Dairying	Cheese factory.
Carrolls		50	Rail and water.	Lumber	Saw mill.
*Castlerock	998	1,300	N. P.; O.-W.; G. N.; river.	Timber; farming	Briquetting plant; pulp mill; sash and door.
*Kelso		2,600	N. P.; O.-W.; G. N.; river.	Timber; farming	Woodworking; fish cannery; pottery works.
Mount Solo		500	Stage to Kelso.	Dairying	Creamery; cheese factory.
Pigeon Springs			Kalama river	Timber	Tie camp.
*Woodland	384	800	River and rail.	Dairying; timber	Saw and planing mill; cannery; condensery.

OPENINGS FOR MANUFACTURING ENTERPRISES—CONTINUED.

County and City or Postoffice	Population		Transportation	Resources	Industries Requested
	1910 Census	1917 Estimate			
DOUGLAS					
Albion	.....	29	G. N.	Wheat	Flour mill.
Bonita	.....		River	Wheat	Grist mill.
Orondo	.....	256	River and rail.	Fruit; farming	Pottery; lime; fruit by-products.
Palsades	.....		G. N.	Fruit	Cannery.
Stowe	.....		Motor truck	Dairying; fruit	Cheese factory.
*Waterville	900	1,500	G. N. branch	Fruit; farming	Starch factory; cereal mill.
FERRY					
Coyada	.....	100	River	Mineral	Ore concentrator.
*Keller	.....	200	Auto		Box factory; concrete blocks; paper mill.
*Orient	.....	300	G. N.		Box factory.
FRANKLIN					
*Connell	.....	300	N. P.; O.-W. branch	Wheat; fruit	Flour mill.
Kablotus	.....	200	O.-W.; S. P. & S.	Wheat	Flour mill.
*Pasco	2,083	3,500	Rail and water.	Wheat; livestock	Woolen mill; wool scouring.
GARFIELD					
Peola	.....		17 miles to railroad.	Wheat	Blacksmith shop.
GRANT					
Adrian	.....	100	N. P.; G. N.	Dairying; wheat	Creamery; flour mill.
*Ephrata	323	550	G. N.	Wheat	Flour mill.
Krupp	.....	300	G. N.	Wheat	Flour mill.
Moses Lake	.....	100	Branch C. M. & St. P.	Fruit; wheat	Flour mill; cannery.
*Quincy	264	365	G. N.	Fruit; wheat	Flour mill.
Ruff	.....	75	C. M. & St. P.	Fruit; wheat	Flour mill; brick.
Stratford	.....		G. N.	Fruit; wheat	Ice and cold storage.
Wahluke	.....		River	Fruit; wheat	Brick and tile.
*Warden	.....	350	C. M. & St. P.	Wheat	Flour mill.
Wheeler	.....	50	Near C. M. & St. P.	Farming; fruit	Pickle plant.
GRAYS HARBOR					
*Aberdeen	13,600	18,333	N. P.; C. M. & St. P.; ocean.	Timber	Paper and pulp mill.
Bay City	.....	60	Deepwater; railroad	Timber	Paper and pulp mill.
Carlisle	.....	800	Railroad	Timber	Box factory.

*Cosmopolis	1,132	3 railroads	Timber	Cannery; shipyard; paper mill.
*Elma	1,532	N. P.; C. M. & St. P.; O.-W.	Timber; farming	Woodworking; canneries; cigar factory.
*Hoquiam	8,171	Rail and ocean	Timber	Woodworking; shipbuilding, woolen mills; pulp and paper; sash and door.
Melbourne	150	rail and water	Timber	Saw and shingle mills.
*Montesano	3,000	rail and water	Timber	Condensery; box, button and starch factories.
*Oakville	465	N. P.	Dairying; farming	Cheese; glove factory; cannery.
Quinault	350	Auto truck	Dairying; timber	Cannery.
ISLAND				
Clinton	60	Steamer	Dairying; farming	Cheese and cannery.
*Coupeville	500	Steamer	Dairying; farming	Rustic furniture.
*Langley	400	Steamer	Dairying; farming	Cannery; cannery; saw mill; box factory.
Saratoga	100	Steamer	Dairying; farming	Cannery; cannery; saw mill; box factory.
JEFFERSON				
Gardner	25	Rail and water	Timber	Shingle mill; box factory.
Hadlock	300	Rail and water	Timber	Ship yard; saw mill.
*Port Townsend	4,180	C. M. & St. P.; steamer	Timber	Saw and shingle mill; ship yard.
Quilcene	700	Rail and water	Timber	Piles; shingle and saw mill.
Shine	200	Steamer	Timber	Shingle mill.
KING				
Albina	500	C. M. & St. P.; interurban .....	.....	Cannery and cannery.
*Auburn	957	N. P.; C. M. & St. P.; O.-W.; G. N.; interurban	Fruit; dairying	Cheese factory; cannery; cannery.
Berlin	200	G. N.	Timber	Saw and shingle mill; cement.
*Carnation	500	.....	Fruit; timber	Cannery; shingle mill.
Factoria	300	N. P.; lake steamers	Coal; fruit	Coal tar chemical plant; cannery.
Houghton	300	Lake Washington .....	.....	Saw mill.
*Issaquah	628	N. P.	Coal; timber	Coal by-products; cannery.
Kennydale	500	Boat and rail	Timber	Box factory; cannery.
*Kent .....	.....	.....	Dairying	Bed; cannery.
*Kirkland	532	Lake Washington; N. P.	Farming	Ship yards; box factory.
*Lisabuela	250	Sound steamers	Fruits; berries	Cannery.
Medina	300	Ferry to Seattle .....	.....	Cannery.
*North Bend	299	N. P.; C. M. & St. P.	Dairying; timber	Box factory; cannery; cannery.
Portage	150	Steamer	Fruits; berries	Cannery; vinegar plant.
*Renton	3,750	C. M. & St. P.; N. P.; Int.	Coal; lumber	Furniture; paper; cannery; cannery.
Scenic	75	G. N.	Lumber	Shingle mill.
*Seattle	366,445	All railroads and steamers	Metropolitan	All branches.
Tuckwila	400	Railroads; interurban	Gardening	Iron foundry; cannery.
*Vashon	500	Steamer	Fruits; berries	Box factory; cannery.

OPENINGS FOR MANUFACTURING ENTERPRISES—CONTINUED.

County and City or Postoffice	Population		Transportation	Resources	Industries Requested
	1910 Census	1917 Estimate			
KITSAP					
Bangor .....	.....	250	Sound steamer	Timber; farming	Saw and shingle mill.
*Bremerton	2,993	6,000	Sound steamer	Navy Yard	Ship yard; woodworking; apron factory.
Nellita .....	.....	90	Sound steamer	Fruit; fishing	Fruit; fish cannery.
*Port Orchard	682	1,000	Sound steamer	Dairying; farming	Concrete block plant; box factory; ship yard; cannery.
*Poulsbo	364	600	Sound steamer	Fishing; farming	Woodworking; codfish packing; ship yard; cannery.
*Rollingbay .....	.....	400	Sound steamer	Poultry; farming	Cannery; ship building.
*South Colby .....	.....	300	Sound steamer	Farming; fruit	Cannery.
Tracyton .....	.....	250	Sound steamer	Poultry; farming	Cannery.
*Winslow .....	.....	300	Sound steamer	Gardening	Cannery.
KITTITAS					
*Ellensburg	4,209	7,500	N. P.; C. M. & St. P.	Farming; fruit	Sugar; cheese; milk.
*Kittitas .....	.....	250	C. M. & St. P.	Farming; fruit	Creamery; sugar; brick.
Roslyn	3,126	3,000	N. P.	Coal	Charcoal; brick and tile.
Rozet .....	.....	75	N. P.	Farming	Silica mill.
Thorp .....	.....	375	N. P.; C. M. & St. P.	Farming	Fruit by-products.
Wynner .....	.....	.....	N. P.	Farming	Silica mill.
KUCKWAT					
Alderdale .....	.....	50	S. P. & S.; steamer	Wheat	Flour mill.
Borr .....	.....	1,575	Stage	Logging	Creamery.
*Goldendale .....	.....	.....	Railroad	Fruit; wheat	Box factory; cannery.
*Lyle .....	.....	250	S. P. & S.; steamer	Fruit; timber; farming	Flour; sash and door; saw mill; water power; brick and pottery.
Sundale .....	.....	800	S. P. & S.; steamer	Fruit; wheat	Flour mill; cannery.
Timber Valley .....	.....	.....	Logging road to S. P. & S.	Lumber	Saw mill; cannery; creamery.
*White Salmon .....	.....	.....	.....	Fruit; dairying	Saw mill; cannery; creamery.
LEWIS					
Alta Vista .....	.....	50	Auto	Farming	Flour mill.
*Centralia	7,311	11,000	Railroad center	Timber; farming	Cannery; vinegar; pickle; sash and door; brick and tile; broom handle and box.
*Chelalis	4,507	6,000	Railroad center	Timber; agriculture	Saw mill; brick and tile; fir door; starch.
Exelune .....	.....	.....	N. P.; O.-W.; G. N.	Dairying; timber	Condensery.

Lindberg	50	T. E.	Timber	Saw mill.
Littell		N. P.	Timber; farming	Cannery; brick yard.
Mayfield	30	Auto truck	Farming	Cannery; cannery.
Mossy Rock	150	Auto truck	Farming	Cannery; cheese; creamery.
*Pe Ell	838	N. P.	Timber	Saw mill; creamery.
Iandle	100	Auto truck	Water power; agriculture	Cannery.
Swofford		Auto truck	Dairying; farming	Creamery and cheese factory.
*Toledo	375	Auto truck and steamer	Fruit; farming	Logging; cannery.
*Winlock	1,140	Main line N. P.	Timber; farming	Sash and door; brick and tile.
LINCOLN				
Edwall	300	G. N.	Wheat	Flour mill; creamery.
Fishtrap	15	N. P.	Farming; dairying	Creamery and cheese factory; feed mill.
Lincoln		G. N. and river.	Water power	Cannery; saw mill; box factory.
Marshall		N. P.; S. P. & S.		General factories.
Miles	20	25 miles from railroad.	Mining	Smelter.
*Odessa	885	G. N.	Wheat	Combine harvester factory.
Peach		Auto and river.	Fruit	Canning factory; box factory.
MASON				
Allyn	125	Sound steamer	Timber	Saw and shingle mill; cannery.
Detroit	80	Sound steamer	Timber; fruit	Saw mill and box factory.
Grant	30	Sound steamer	Farming	Cannery.
Matlock	150	Peninsular R. R.	Timber; farming	Cannery; cheese factory; cannery.
Tahuya	40	Sound steamer	Timber	Saw mill; pottery.
Union City	75	Sound steamer	Timber	Saw mill; woodworking plants.
OKANOGAN				
Leese		G. N.	Timber; farming	Saw mill.
*Loomis			Cattle; fruit	Cannery; packing plant.
Malott	100	G. N.	Fruit; grain	Box factory.
*Methow	350	11 miles to railroad	Wheat	Broom factory; cannery.
Molson		G. N.		Lime; sash and door; creamery.
Nespelem	1,000	G. N.	Mining; fruit; farming.	Flour; saw mill.
*Oroville		G. N.; river steamer	Cattle; fruit	Cannery.
*Pateros		17 miles to railroad.	Cattle; wheat; timber.	Flour mill; smelter; saw mill.
Synarep	400	Auto truck	Farming; cattle	Flour mill; saw and box factory.
*Twisp	300	Auto truck	Mining	Flour mill.
*Winthrop				Smelter.
PACIFIC				
Chetllo		Deepwater ships	Fish; timber	Fish and fruit canneries; saw and pulp mill.
Frances	200	N. P.	Timber	Saw and shingle mill.
Oysterville	115	Stage to railroad.	Fishing	Cannery.
*South Bend	3,023	N. P.; C. M. & St. P.; Str.	Timber; fish	Ship yard; wooden toy factory.

OPENINGS FOR MANUFACTURING ENTERPRISES—CONTINUED.

County and City or Postoffice	Population		Transportation	Resources	Industries Requested
	1910 Census	1917 Estimate			
PEND OREILLE					
Camden .....	.....	50	G. N.	Water power	Saw and feed mill.
Locke .....	.....	20	C. M. & St. P.	Water power	Paper mill.
*Metalline Falls .....	.....	300	C. M. & St. P.	Mining; timber	Pulp mill.
Tiger .....	.....	75	C. M. & St. P.	Water power	Box factory; paper mill.
PIERCE					
Alder .....	.....	.....	C. M. & St. P.	Timber	Saw mill.
Bismark .....	.....	.....	T. E. and electric cars	Timber	Saw mill.
*Buckley	1,272	1,700	N. P.	Coal; timber; farming	Shingle mill; laundry.
Elbe .....	.....	150	C. M. & St. P.	Timber	Shingle and saw mill.
Gig Harbor .....	.....	700	Sound steamer	Timber; farming	Shingle; fish cannery; creamery.
Graham .....	.....	8	C. M. & St. P.	Timber; dairying	Creamery; cheese; wood mfg. plant
Kapowsin .....	.....	600	Rail	Timber; water power	Cheese; saw mill.
Lakeview .....	.....	200	N. P.; G. N.	Dairying; timber	Sash and door.
*Orting	799	900	N. P.	Timber; farming	Shingle; saw; woodworking; sugar condenser.
*Puyallup	4,544	5,900	Steam and electric roads	Fruit; berries	Cigar factory; bottling works.
South Prairie	264	300	Rail	Timber; coal; clay	Shingle and saw mill.
Steilacoom	430	650	Rail and boat	Medical springs	Cannery; creamery; saw; shingle; box; ship yard.
*Sumner	892	1,750	Rail and electric	Fruit; farming	Condenser; pickle; tin; auto; furniture.
Sylvan .....	.....	160	Boat	Fruit; farming	Cannery; fruit packing.
*Tacoma .....	.....	120,000	All railroads and steamers	Metropolitan	All branches.
SAN JUAN					
Dolphin .....	.....	.....	Sound steamer	Limestone	Lime kiln; cement.
West Sound .....	.....	150	Sound steamer	Farming	Cannery.
SKAGIT					
*Anacortes	4,168	6,000	Rail and water	Timber; fish	Furniture; strawboard; cereal; ship yard; foundry; codfish plant.
*Burlington	1,302	1,400	G. N.; electric road	Timber; farming	Condenser; cereal strawboard.
*Conway .....	.....	.....	G. N.	Dairying	Fruit and vegetable cannery.
Dewey .....	.....	.....	Rail .....	.....	Fish; fruit cannery; saw mill; smelter; ship yard.
McMurray .....	.....	400	N. P.	Timber	Condenser.
*Mt. Vernon	2,381	3,500	Rail and water	Dairying	Condenser; vegetable cannery.

SKAMANIA

*Carson
*Stabler
*Stevenson

250
.....
387
800

S. P. & S.; steamer.
14 miles to railroad.
S. P. & S.; steamer.

Timber; farming
Timber; farming
Timber; farming

Creamery; fruit dryer.
Shingle mill.
Sash and door; box; creamery.

SNOHOMISH

*Arlington
*East Stanwood.
*Edmonds
*Everett
*Granite Falls
Hartford
Lochloy
*Marysville
*Monroe
*Nukiteo
*Silverton
*Snohomish
*Sultan

24,814
714
.....
.....
.....
.....
1,239
1,552
.....
.....
.....
.....
576

Rail and steamer.
Rail
Rail
N. P.
Rail and water.
G. N.; C. M. & St. P.
Rail and water.
Hartford & Eastern R. R.
G. N.; N. P.; C. M. & St. P.
G. N.

Timber; dairying
Farming; timber
Timber; fruit
Timber; fish
Timber; granite; coal.
Lime.
Lime.
Timber; farming
Dairying; agriculture
Dairying; agriculture
Timber; mineral
Timber; mining; dairying.

Box factory; condensery; pottery factory.
Cheese.
Bottling works; general manufacturing plants.
Furniture; ship yard.
Lime.
Lime.
Cannery; creamery; box factory.
Paper; box; cheese; brick; pickle.
Fish cannery; ship yard.
Saw; shingle; smelter.
Paper mill; ship yard; rubber goods factory.
Cannery; broom handle.

SPOKANE

Chattaroy
*Cheney

100
1,500
.....
1,207

G. N.
Railroads

Farming
Farming; dairying

Box factory; creamery.
Brick; flour; vinegar and pickle; condenser.

Chester
*Deer Park
Denison
Green Acres
*Four Lakes
Kiesling
Latah
*Spangle
*Spokane

50
875
1,300
80
500
500
339
.....
339
299
104,402

S. F. & N.
Stage and rail.
S. I. R. R.
W. W. P. Elec. R. R.
S. I. R. R.
O. W.
N. P.
All railroads

Farming
Timber; fruit; mining
Farming
Farming
Fruit
Farming
Metropolitan

Box factory.
Pottery.
Silica mill; fruit by-products.
Cannery.
Vinegar plant.
Vinegar plant.
Creamery.
Flour mill; creamery.
Shoe; glass; pottery; trunk; miscellaneous.

STEVENS

Addy
Cedonia
Clayton
*Colville

400
.....
400
.....
1,512

G. N.
Auto trucks
S. F. & N.
G. N.

Lumbering
Farming
Farming
Farming; timber; mining

Saw mill.
Creamery.
Creamery.
Box, broom, brick, silo and cheese factories.

*Gifford
Harvey
Hunters
Marble

60
225
260
100

Auto truck
14 miles to railroad.
Auto truck
G. N.

Farming
Farming
Farming
Timber; marble

Cannery and evaporator; creamery.
Cannery.
Creamery and cheese.
Saw mill; marble works; brick yard.

*Northport
Orin

1,600
150

G. N.
G. N.

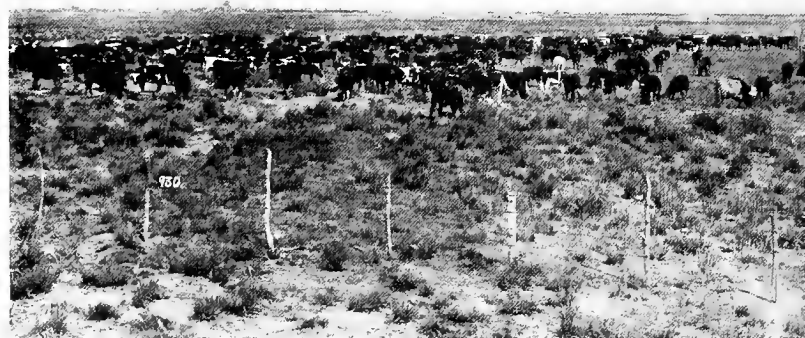
Timber; farming
Timber

Feed; pulp; box; creamery.
Saw mill.

OPENINGS FOR MANUFACTURING ENTERPRISES—CONTINUED.

County and City or Postoffice	Population		Transportation	Resources	Industries Requested
	1910 Census	1917 Es- timate			
STEVENS—Concluded.					
Park Rapids .....	.....	.....	16 miles to railroad	Timber	Saw and shingle mill.
Tum Tum .....	.....	200	Auto truck	Timber	Saw mill.
Turk .....	.....	40	County road	Timber	Saw mill.
Valley .....	.....	400	S. F. & N.	Farming	Creamery or cheese factory.
THURSTON					
*Olympia	6,996	12,000	N. P.; O.-W.; steamers; stages	Timber; farming; oysters	Saw mill; ship building; brick and tile.
Puget .....	.....	.....	Boat	Timber	Saw mill.
WAHKIAKUM					
*Cathlamet	352	500	Deepwater steamers	Timber	Saw and shingle mill.
Deep River .....	.....	500	Deepwater steamers	Timber; farming	Cannery; lumber mill.
Eden .....	.....	125	Deepwater steamers	Farming	Cheese.
Grays River .....	.....	75	Deepwater steamers	Timber	Saw and shingle mill.
WALLA WALLA					
Burbank .....	.....	200	3 railroads; water	Fruit; farming	Concrete blocks.
*Prescott	502	700	O.-W.	Fruit; farming	Dairy products.
*Touchet .....	.....	600	O.-W.	Fruit; farming	Flour; creamery; fruit packing.
*Walla Walla	19,364	24,200	O.-W.; N. P.	Fruit; farming	Condensery; cannery; strawboard.
WHATCOM					
*Bellingham	24,298	35,000	Water and rail	Timber; farming	Paper; brick and tile; furniture; broom.
*Blaine .....	.....	3,500	Water and rail	Timber; farming	Sash and door; ship yard; cannery.
Ferndale	691	1,300	G. N.	Timber; farming	Fruit evaporator; laundry.
Glacier .....	.....	100	B. & N.	Mining	Smelter.
Kendall .....	.....	250	B. & N.	Farming	Creamery.
Lawrence .....	.....	200	N. P.	Timber; farming	Creamery; saw and shingle mill.
*Sumas	902	2,000	N. P.; C. P.; G. N.	Timber; farming	Cannery; cheese factory.
Van Buren .....	.....	.....	B. & N.	Farming	Cheese factory.
WHITMAN					
*Albion .....	.....	400	Branch O.-W.	Wheat	Flour mill.
Almota .....	.....	100	N. P.; O.-W.	Farming; wheat	Creamery; water power.
*Colfax	2,873	3,250	2 railroads	Farming; wheat	Cannery.
*Farmington	489	800	O.-W.; N. P.	Farming; wheat	Cannery; vinegar.

*Palouse	1,549	1,600	2 railroads; electric road.....	Farming; wheat	Flour and feed mill; straw paper mill.
*Pullman	2,607	3,000	N. P.; O.-W.....	Farming; wheat	Fruit by-products.
*Rosalia	767	800	3 railroads	Farming; wheat	Cider and vinegar; laundry; flour.
*St. John	421	650	O.-W.....	Farming; wheat	Flouring mill.
Tekoa	1,694	2,000	O.-W.....	Farming; wheat	Cannery.
*Uniontown .....	.....	650	N. P.....	Farming; wheat	Flour mill.
Wawawai .....	.....	.....	O.-W.....	Farming; wheat	Cannery.
YAKIMA					
Byron .....	.....	180	N. P.....	Fruit; farming	Cannery; fruit by-products.
Cowiche .....	.....	.....	Rail	Timber; dairying	Saw mill; creamery and cheese.
*Grandview	320	650	N. P.; O.-W.....	Fruit; Farming	Cannery.
*Granger .....	.....	500	N. P.; O.-W.....	Fruit; Farming	Brick and tile.
Mabton	666	750	N. P.....	Fruit; Farming	Cannery; alfalfa meal; sugar.
*Toppenish	1,598	2,500	N. P.....	Fruit; Farming	Fruit by-products; alfalfa; grist mill; starch.
*Yakima	14,082	21,000	N. P.; O.-W.....	Fruit; Farming	Evaporator; starch; broom; condenser; alfalfa; flour.
*Zillah .....	.....	600	N. P.; O.-W.....	Fruit; Farming	Cannery; fruit by-products.



SCENES FROM THE LIVESTOCK INDUSTRY.

No. 1. Big packing plant at Spokane. No. 2. Stock yard at Tacoma.
No. 3. Hogs fattening at Kennewick. No. 4. Beef cattle feeding
in the Yakima Valley.

EXPLAINING TABLES SHOWING RAW MATERIALS.

The following classifications are for the purpose of indicating the most important raw materials of the stat  and in what counties the bulk of them are to be found. In the first table the raw materials themselves are classified and the counties containing an appreciable amount listed after each item. The second is merely the converse of the first and is given for the sake of convenience, so that one may note readily the most common materials available in any single county or group of counties.

These tables have their limitations. For instance, certain of the more common materials listed in the classification such as fruits, berries and vegetables may be present to a certain extent in practically all the counties. In such cases it has seemed advisable to mention only those counties which have produced them in sufficient commercial quantities to constitute a real industrial factor.

The extent to which each raw material exists in any division is roughly indicated by the letters "vp" very plentiful, "p" plentiful, and "l" little. In using these signs it has been necessary to take into consideration not alone the actual quantity existing, but also its relative importance among the products of the county for which it is mentioned. An example of this is timber in Pend Oreille county which is marked "vp" because it is relatively very plentiful as compared with other resources of that county and also as compared with other neighboring districts; although in actual quantity this county has far less timber than many of the heavily forested sections of the western part of the state.

The data contained in these tables was secured from many sources, including county officials, Federal and state reports, chambers of commerce, and various individual experts; also by personal visit and investigation on the part of a representative of this bureau. While not exhaustive, they will prove a convenient reference for those who desire to survey briefly the field of opportunity offered by individual counties or to trace quickly the sections where certain resources may be found.

DISTRIBUTION OF WASHINGTON'S PRINCIPAL RAW MATERIALS AND RESOURCES.

AGRICULTURAL PRODUCTS.

BARLEY: Asotin, p; Columbia, vp; Garfield, vp; Spokane, p; Walla, vp; Whitman, vp.

BERRIES: Grown abundantly in nearly all counties. Commercial shipments from Benton, p; Clarke, p; Island, p; King, vp; Kitsap, vp; Klickitat, vp; Lewis, vp; Pierce, vp; Spokane, vp; Yakima, vp.

DAIRY: Clallam, p; Clarke, p; Cowlitz, p; Grant, l; Grays Harbor, p; Island, p; Jefferson, p; King, vp; Kitsap, p; Kittitas, vp; Lewis, vp; Okanogan, p; Pacific, p; Pierce, vp; San Juan, p; Skagit, vp; Snohomish, vp; Spokane, vp; Stevens, p; Thurston, p; Wahkium, p; Walla Walla, p; Whatcom, vp; Whitman, p; Yakima, vp.

FRUITS (Orchard): Asotin, p; Benton, p; Chelan, vp; Clarke, vp; Columbia, p; Cowlitz, p; Douglas, p; Ferry, l; Franklin, l; Garfield, p; Grant, p; Island, l; King, p; Kitsap, p; Kittitas, vp; Klickitat, vp; Lewis, p; Lincoln, p; Mason, l; Okanogan, vp; Pierce, vp; San Juan, p; Skagit, p; Skamania, p; Snohomish, p; Spokane, vp; Stevens, p; Thurston, p; Walla Walla, vp; Whatcom, p; Whitman, p; Yakima, vp.

LIVESTOCK: Adams, p; Asotin, p; Columbia, p; Douglas, l; Ferry, p; Garfield, vp; Grant, p; King, vp; Kittitas, p; Klickitat, p; Lincoln, p; Okanogan, vp; Pierce, p; Skagit, p; Spokane, p; Stevens, p; Whatcom, p; Walla Walla, p; Whitman, vp; Yakima, vp.

OATS: Adams, p; Clarke, p; Douglas, p; Grays Harbor, p; Island, p; Kittitas, vp; Lewis, vp; Lincoln, p; Okanogan, p; San Juan, p; Skagit, vp; Snohomish, p; Spokane, vp; Stevens, p; Thurston, p; Walla Walla, p; Whatcom, p; Whitman, vp; Yakima, p.

POULTRY: Adams, l; Clarke, p; Douglas, p; Island, p; King, vp; Kitsap, vp; Lewis, vp; Pierce, vp; San Juan, p; Snohomish, vp; Spokane, vp; Stevens, p; Thurston, p; Walla Walla, p; Whatcom, p; Whitman, vp; Yakima, vp.

SUGAR BEETS: Benton, p; Yakima, vp; Kittitas, l.

VEGETABLES: Grown abundantly in practically all counties. Large commercial shipments at present from Benton, Clarke, Columbia, Cowlitz, Kittitas, Klickitat, Lewis, Pierce, Skamania, Spokane, Walla Walla, Yakima.

WHEAT: Adams, vp; Asotin, vp; Benton, vp; Columbia, vp; Douglas, vp; Franklin, vp; Garfield, vp; Grant, vp; Kittitas, p; Klickitat, vp; Lincoln, vp; Okanogan, vp; Spokane, vp; Walla Walla, vp; Whitman, vp; Yakima, p. A softer wheat will grow in any part of western Washington.

WOOL: Asotin, p; Benton, vp; Columbia, p; Franklin, p; Garfield, p; Grant, p; Kittitas, p; Klickitat, p; Okanogan, p; San Juan, p; Stevens, p; Walla Walla, vp; Whitman, vp; Yakima, vp.

MARINE PRODUCTS.

CLAMS: Clallam, p; Grays Harbor, vp; Mason, p; Pacific, p; Thurston, p.

CRABS: Clallam, vp; Grays Harbor, vp; Pacific, vp.

FISH: Clallam, vp; Clarke, p; Cowlitz, p; Grays Harbor, vp; Island, vp; Jefferson, vp; King, vp; Kitsap, vp; Mason, p; Pacific, p; Pierce, p; San Juan, vp; Skagit, vp; Skamania, vp; Wahkiakum, vp; Whatcom, vp.

KELP: Clallam, vp; Island, p; San Juan, vp. Some kelp is found in the waters of all Sound counties.

OYSTERS: Mason, vp; Pacific, vp; Thurston, vp.

WHALES: Grays Harbor, vp.

MINERALS—NON-METALS.

CEMENT MATERIALS: Asotin, p; Chelan, p; Ferry, p; King, vp; Okanogan, p; Pend Oreille, vp; San Juan, vp; Skagit, vp; Snohomish, vp; Stevens, p; Whatcom, p.

CLAY: (Bricks are made from local clay deposits at the principal towns in more than half the counties). Adams, l; Benton, p; Chelan, p; Clallam, p; Clarke, p; Columbia, p; Cowlitz (fire and pottery), vp; Douglas (pottery), p; Ferry; Garfield; Grays Harbor, vp; Jefferson, vp; King (fire, pottery and sewer pipe), vp; Kitsap, p; Kittitas, p; Klickitat, p; Lewis (kaolin and pottery), vp; Lincoln, p; Okanogan, vp; Pacific, p; Pierce (kaolin and fire), p; Skagit, p; Snohomish, p; Spokane (sewer pipe), vp; Stevens (kaolin and pottery), p; Walla Walla, p; Whatcom, vp; Whitman; Yakima, p.

COAL: Asotin, l; Clallam, l; Cowlitz, p; Grays Harbor (prospects); King, vp; Kittitas, vp; Lewis, vp; Pierce, vp; Skagit, p; Snohomish, p; Thurston, p; Whatcom, p.

GAS: Benton, l.

GRANITE: Garfield, l; King, p; Mason, p; Pierce, l; Snohomish, p; Spokane; Stevens; Whitman.

GYP SUM: Chelan.

LIME FLUX: San Juan, vp; Stevens, p.

LIME STONE (building): Chelan, p; Clallam, p; Ferry, p; Douglas, p; Pend Oreille, p; Snohomish, vp; Stevens, p.

MARBLE: Chelan; Lincoln, l; Snohomish, p; Spokane, l; Stevens, vp; Whatcom, l.

OIL (only prospects): Clallam, Jefferson; Lewis.

ONYX: Garfield, l.

SANDSTONE: Clallam, l; Ferry, p; King, l; Kitsap, p; Pierce, p; San Juan, p; Skagit, p; Thurston, vp; Whatcom, p.

SILICA: Benton, vp; Clallam, p; Franklin, p; Grant, vp; Kittitas, p; Spokane; Yakima.

MINERALS—METALS.

ARSENIC: King; Lewis; Okanogan; Snohomish.

COPPER: Chelan; Ferry; King; Lewis; Okanogan; Pierce; Skagit; Skamania; Snohomish; Stevens.

GOLD: Asotin; Chelan; Clallam; Clarke; Douglas; Ferry; King; Kittitas; Lincoln; Okanogan; Pend Oreille; Skamania; Snohomish; Stevens; Whatcom; Whitman; Yakima.

IRON: King; Kittitas; Skagit; Snohomish; Stevens.

LEAD: Chelan; Lewis; Lincoln; Okanogan; Pend Oreille; Skamania; Snohomish; Spokane; Stevens.

MANGANESE: Grays Harbor; Okanogan; Mason.

MOLYBDENUM: Chelan; Ferry; Okanogan; Pend Oreille; Snohomish.

QUICK SILVER: Kittitas; Lewis.

SILVER: Chelan; Ferry; Lincoln; Okanogan; Pend Oreille; Skagit; Stevens.

TUNGSTEN: Ferry; Okanogan; Spokane; Stevens.

ZINC: Okanogan; Pend Oreille; Snohomish; Stevens.

TIMBER.

Asotin, l; Chelan, p; Clallam, vp; Clarke, p; Columbia, l; Cowlitz, vp; Ferry, vp; Garfield, l; Grays Harbor, vp; Island, p; Jefferson, vp; King, vp; Kitsap, p; Kittitas, p; Klickitat, l; Lewis, vp; Lincoln, l; Mason, vp; Okanogan, p; Pacific, vp; Pend Oreille, vp; Pierce, vp; Skagit, vp; Skamania, vp; Snohomish, vp; Spokane, l; Stevens, p; Thurston, vp; Wahkiakum, vp; Whatcom, vp; Yakima, l.

WATER POWER.

Adams, l; Asotin, p; Benton, p; Chelan, vp; Clallam, vp; Clarke, p; Columbia, p; Cowlitz, vp; Ferry, p; Franklin, p; Grant, vp; Grays Harbor, p; Jefferson, vp; King, vp; Kittitas, vp; Klickitat, vp; Lewis, vp; Lincoln, vp; Mason, vp; Okanogan, p; Pacific, p; Pend Oreille, vp; Pierce, vp; Skagit, vp; Skamania, vp; Snohomish, vp; Spokane, vp; Stevens, vp; Thurston, p; Wahkiakum, vp; Whatcom, vp; Yakima, vp.

PRINCIPAL RAW MATERIALS AND RESOURCES OF
WASHINGTON BY COUNTIES.

ADAMS: livestock, p; poultry, l; oats, p; wheat, vp; clay, l; waterpower, l.

ASOTIN: barley, p; fruit, p; livestock, p; wheat, vp; wool, p; coal, l; cement material, p; gold, l; timber, l; waterpower, p.

BENTON: berries, p; fruit, p; sugar beets, p; vegetables, p; wheat, vp; wool, vp; clay, p; natural gas, l; silica, vp; waterpower, p.

CHELAN: fruit, vp; cement material, p; clay, p; limestone, p; marble; mines (copper, lead, silver, gold, gypsum, molybdenum, quicksilver, zinc); timber (saw and pulp), p; waterpower, vp.

CLALLAM: dairies, p; clams, p; crabs, vp; fish, vp; kelp, vp; clay, p; coal, l; silica, p; limestone, p; sandstone, l; metals (mostly prospects), gold, l; oil (prospects); timber, vp; waterpower, vp.

CLARKE: berries, p; dairies, vp; fruit, vp; oats, p; poultry, p; vegetables, p; fish, p; clay, p; gold, l; timber, p; waterpower, p.

COLUMBIA: barley, vp; fruit, p; livestock, p; vegetables, p; wheat, vp; wool, p; clay, p; timber, l; waterpower, p.

COWLITZ: dairies, p; fruit, p; vegetables, p; fish, p; clay, vp; coal, p; timber, vp; waterpower, vp.

DOUGLAS: fruit, p; livestock, l; oats, p; poultry, p; wheat, vp; clay (pottery), p; limestone, p; gold, l.

FERRY: fruit, l; livestock, p; cement material, p; clay, p; limestone, p; sandstone, p; metals (cobalt, copper, gold, lead, molybdenum, silver, tungsten, zinc); timber, p; waterpower, p.

FRANKLIN: fruit, l; wheat, vp; silica, p; wool, p; waterpower, p.

GARFIELD: barley, vp; fruit, p; livestock, vp; wheat, vp; wool, p; clay (brick), p; granite, l; onyx, l; timber, l.

GRANT: dairies, l; fruit, p; livestock, p; wheat, vp; wool, p; potash, l; silica, vp; Soap lake mineral water; waterpower, vp.

GRAYS HARBOR: dairies, p; oats, p; clams, vp; crabs, vp; fish, vp; whales, vp; manganese; clay (brick), vp; coal (prospects); oil (prospects); timber, vp; waterpower, p.

ISLAND: berries, p; fruit, l; dairies, p; poultry, p; oats, p; fish, vp; kelp, p; timber, p.

JEFFERSON: dairies, p; fish, vp; clay, vp; minerals (undeveloped); oil (prospects); timber, vp; waterpower, vp.

KING: berries, vp; fruits, p; dairies, vp; livestock, vp; poultry, vp; fish, vp; cement material, vp; clay, vp; coal, vp; granite, p; sandstone, l; metals (arsenic, copper, gold, iron), l; timber, vp; waterpower, vp.

KITSAP: berries, vp; fruit, p; dairies, p; poultry, vp; fish, vp; clay, p; sandstone, p; timber, p.

KITTITAS: dairies, vp; fruit, vp; livestock, p; oats, vp; wheat, p; vegetables, vp; sugar beets, l; wool, p; clay, p; coal, vp; metals (largely undeveloped), gold, quicksilver, iron; silica, p; timber, p; waterpower, vp.

KLICKITAT: berries, vp; livestock, p; fruit, vp; vegetables, p; wheat, vp; wool, p; clay, p; stone, p; timber, l; waterpower, vp.

LEWIS: berries, vp; dairies, vp; fruit, p; oats, vp; poultry, vp; vegetables, vp; wool, p; clay, vp; coal, vp; metals (arsenic, copper, lead, quicksilver); oil (prospects); timber, vp; waterpower, vp.

LINCOLN: fruit, p; livestock, p; oats, p; wheat, vp; clay, p; marble, l; mines (largely undeveloped, gold, lead, silver); timber, l; waterpower, vp.

MASON: fruit, l; clams, p; fish, p; oysters, vp; copper, l; granite, p; manganese, p; timber, vp; waterpower, vp.

OKANOGAN: dairies, p; fruit, vp; livestock, vp; oats, p; wheat, p; wool, p; cement material, p; clay, vp; mines (arsenic, copper, epsom salts, gold, lead, manganese, molybdenum, silver, tungsten, zinc); timber, p; waterpower, p.

PACIFIC: dairies, p; clams, p; crabs, vp; oysters, vp; fish, p; clay, p; timber, vp; waterpower, p.

PEND OREILLE: grain, p; hay, p; cement material, vp; limestone, p; mines (gold, lead, molybdenum, silver, zinc); timber, vp; waterpower, vp.

PIERCE: berries, vp; fruit, vp; dairies, vp; livestock, p; poultry, vp; vegetables, vp; fish, p; clay, p; coal, vp; copper, l; granite, l; sandstone, p; timber, vp; waterpower, vp.

SAN JUAN: fruit, p; dairies, p; poultry, p; oats, p; wool, p; fish, vp; kelp, vp; cement material, vp; lime flux, vp; mines (undeveloped); sandstone, p.

SKAGIT: fruit, p; dairies, vp; livestock, p; oats, vp; fish, vp; cement material, vp; clay, p; coal, p; metals (copper, gold, iron, silver); sandstone, p; timber, vp; waterpower, vp.

SKAMANIA: dairies, p; fruit, p; vegetables, p; fish, p; mines (largely undeveloped, copper, lead, gold); timber, vp; waterpower, vp.

SNOHOMISH: fruit, p; dairies, vp; poultry, vp; fish, vp; cement material, vp; clay, p; coal, p; granite, p; limestone, p; marble, p; mines (largely undeveloped, arsenic, copper, lead, gold, iron, molybdenum, zinc); timber, vp; waterpower, vp.

SPOKANE: barley, p; berries, vp; dairies, vp; fruit, vp; livestock, p; oats, vp; poultry, vp; vegetables, vp; wheat, vp; clay, vp; granite, p; marble, l; mines (iron, lead, tungsten); silica, p; timber, l; waterpower, vp.

STEVENS: dairies, p; fruit, p; livestock, p; poultry, p; oats, p; wool, p; cement material, p; clay, p; granite, p; lime flux, p; limestone, p; marble, vp; mines (copper, gold, iron, lead, silver, tungsten, zinc); timber, p; waterpower, vp.

THURSTON: fruit, p; dairies, p; oats, p; poultry, p; clams, p; oysters, vp; coal, p; sandstone, vp; timber, vp; waterpower, p.

WAHKIAKUM: dairies, p; fish, vp; timber, vp; waterpower, vp.

WALLA WALLA: dairies, p; barley, vp; oats, p; vegetables, vp; fruit, vp; livestock, p; poultry, p; wheat, vp; wool, vp; clay, p.

WHATCOM: fruit, p; dairies, vp; livestock, p; oats, p; poultry, p; vegetables, p; fish, vp; cement material, p; clay, vp; coal, p; gold, l; marble, l; sandstone, p; timber, vp; waterpower, vp.

WHITMAN: fruit, p; barley, vp; dairies, p; livestock, vp; oats, vp; poultry, vp; wheat, vp; wool, vp; clay, p; gold, l; granite, p.

YAKIMA: berries, vp; dairies, vp; fruit, vp; livestock, vp; oats, p; poultry, vp; sugar beets, vp; vegetables, vp; wheat, p; wool, vp; clay, p; gold, l; silica, p; timber, l; waterpower, vp.

TABLE SHOWING AREA, 1910 POPULATION, 1917 SCHOOL CENSUS RETURNS, NUMBER OF INCORPORATED CITIES, BANKS, RAILROAD MILEAGE, VALUATION, AND CHIEF RESOURCES OF EACH COUNTY.

COUNTY	County Seat	Area (square miles)	1910 Population	School Population, 1917	No. of Incorporated Towns	No. of Banks	Miles of Steam Railroads in Mileage and Fractions	Actual Value of Property, 1917	Chief Resources and Industries
1 Adams	Ritzville.....	1,912	10,920	3,160	6	7	335.774	\$33,250,672	Wheat Raising.
2 Asotin	Asotin.....	606	5,881	1,777	2	5	None	10,322,265	General Farming, Dairying.
3 Benton	Prosser.....	1,671	7,937	2,470	3	7	908.461	39,610,877	General Farming, Horticulture, Stock.
4 Chelan	Wenatchee.....	2,900	15,104	4,616	5	8	162.273	40,179,673	Horticulture, General Farming.
5 Clallam	Port Angeles.....	1,796	6,755	2,320	2	4	76.557	28,933,503	Lumbering, Fishing.
6 Clarke	Vancouver.....	634	26,115	7,811	6	9	116.042	48,468,678	Prunes, Lumbering, Dairying, Farming.
7 Columbia	Dayton.....	858	7,042	1,968	2	3	88.651	22,364,193	Stock, Fruit, Grain.
8 Cowlitz	Kalama.....	1,133	12,961	3,708	4	5	88.656	31,259,529	Lumbering, Dairying, Fishing.
9 Douglas	Waterville.....	1,787	9,257	3,134	3	6	92.201	29,304,530	Wheat, Fruit, Diversified Farming.
10 Ferry	Republic.....	2,220	4,800	1,833	1	2	128.297	7,388,647	Dairying, Stock Raising, Mining, Farming.
11 Franklin	Pasco.....	1,206	5,133	1,579	3	6	241.062	25,258,100	Wheat Raising.
12 Garfield	Pomeroy.....	694	4,199	1,359	2	2	18.290	14,102,713	Grain, Diversified Farming.
13 Grant	Ephrata.....	2,790	8,038	2,685	1	9	248.270	37,823,539	Wheat Raising, Stock, Fruit.
14 Grays Harbor.....	Montesano.....	1,927	35,590	9,427	8	9	208.894	83,287,404	Timber, Manufacturing, Dairying.
15 Island	Comeville.....	918	4,700	1,546	2	3	None	4,362,988	Dairying, Fruit, Fishing.
16 Jefferson	Port Townsend.....	1,747	8,357	1,573	1	2	37.914	16,736,682	Lumbering and Fishing.
17 King	Seattle.....	2,111	284,638	67,051	17	55	838.943	579,416,786	Shipping, Manufacturing, Farming, Coal.
18 Kitsap	Port Orchard.....	371	17,647	5,889	4	6	None	16,417,015	Lumbering, Stock Raising, Farming.
19 Kittitas	Ellensburg.....	2,329	18,561	5,032	4	7	281.520	50,092,287	Coal Mining, Farming.
20 Klickitat	Goldendale.....	1,825	10,189	2,743	2	6	165.785	34,964,660	General Farming, Horticulture, Stock.
21 Lewis	Chehalis.....	2,349	32,127	11,265	8	12	224.968	57,475,576	Lumbering and Farming.
22 Lincoln	Davenport.....	2,302	17,539	5,766	8	15	204.203	63,946,036	Wheat Raising, Farming.
23 Mason	Shelton.....	699	5,156	1,287	1	1	42.958	14,290,071	Oysters, Logging, Dairying.
24 Okanogan	Okanogan.....	5,221	12,887	4,800	8	16	150.345	21,169,127	Stock Raising, Farming, Horticulture.
25 Pacific	South Bend.....	895	12,532	3,905	3	3	49.594	34,480,735	Shell Fish, Timber, Farming.
26 Pend Oreille	Newport.....	1,325	.....	1,906	3	3	100.089	14,151,200	Mining, Lumbering, Farming.
27 Pierce	Tacoma.....	1,701	120,812	31,203	13	15	484.751	186,674,225	Shipping, Manufacturing, Farming, Berries.
28 San Juan	Friday Harbor.....	1,178	3,603	1,040	1	1	None	3,933,232	Lime, Fishing, Farming.
29 Skagit	Mount Vernon.....	1,774	29,241	8,804	9	16	183.048	51,286,449	Cement, Lumbering, Dairying.
30 Skamania	Stevenson.....	1,685	2,887	783	1	1	49.428	12,987,673	Lumbering, Fishing.
31 Snohomish	Everett.....	2,064	59,209	16,008	12	17	417.096	96,575,824	Lumbering, Manufacturing, Fishing.
32 Spokane	Spokane.....	1,756	139,404	33,925	10	28	546.795	285,179,639	Manufacturing, Agriculture, Mining.
33 Stevens	Colville.....	2,471	25,297	6,167	6	10	142.707	29,234,398	Mining, Lumbering, Farming.
34 Thurston	Olympia.....	769	17,381	5,319	4	3	259.046	34,883,432	Oysters, Farming, Lumbering.
35 Wabikakum	Cathlamet.....	267	3,285	1,049	1	1	None	4,500,846	Lumbering, Fishing, Farming.
36 Walla Walla	Walla Walla.....	1,265	31,661	7,331	3	10	322.328	76,840,873	General Farming, Stock Raising, Wheat.
37 Whitman	Bellingham.....	2,082	49,511	15,543	6	10	201.345	69,058,616	Farming, Lumbering, Fishing.
38 Whitman	Colfax.....	2,108	33,280	10,164	17	33	512.480	114,187,336	Wheat, General Farming.
39 Yakima	Yakima.....	5,659	41,709	13,567	8	19	264.993	74,111,897	Horticulture, Farming, Stock.
Totals.....		66,826	1,141,990	310,323	206	375	7,514.554	\$2,403,921,908	

* Organized, 1911; part of Stevens county.

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